# Electrical World

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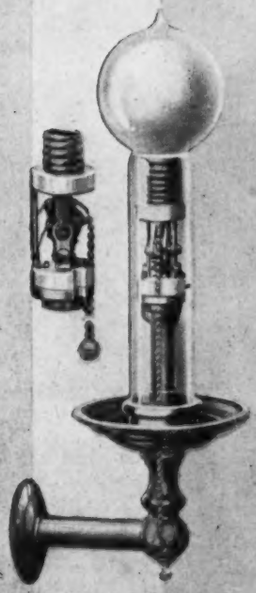

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# Electrical World

*The consolidation of* ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

*Volume* 74 New York, Saturday, August 16, 1919 *Number* 7

## A Friend of Engineers

WHEN Andrew Carnegie gave one million and a half outright for the erection of the Engineering Societies Building and the Engineers' Club of New York City he paid a signal tribute to engineers. Unlike many public benefactions bestowed by the steel magnate, there were no stipulations connected with the gift, since Mr. Carnegie felt that engineers could be relied on to give a good account of their stewardship. To engineers and engineering he attributed his great fortune, and his interest in the welfare of the profession and his desire that engineers should get together and know each other better was not passive. His early connection with the electrical industry, which then comprised the telegraph and telephone, was only incidental. His fame rests chiefly on his ability as an organizer of the great steel industry, but his munificence in the cause of technical education, his donations to the arts in the shape of libraries and organs, and his pension scheme for teachers made his name known to hundreds of millions throughout the world. He planned much for his fellow man, although many of his ideas came to naught, and history alone can pass judgment on the worth of others. With this, however, all men agree: his intentions were good and his ideals high. In his death humanity has lost a friend and the engineering profession a patron and great admirer.

*It has occurred to some central-station operators to be more thankful than ever that their properties are divorced from local electric railways during this era of strikes. The present efficiency of gasoline motor transportation in most cities prevents a traction tie-up from being really serious. However, a strike that completely interrupts electric service is something no community wants to face.*

## Expert Help on Rates

CENTRAL stations are not the only ones to complain about inconsistencies in rate schedules, nor does the public alone suffer from such irregularity. At a recent convention of electric light and power men the electrical engineer of a public utilities commission complained that among many of the smaller companies the basic principles of rate making are apparently unknown. He cited two schedules which were typical of many the commission had been asked to approve. In one the demand charge was reasonable, but the energy charge was below the cost of production; in the other the average rate became higher with an increase in load factor.

In view of these circumstances and others connected with higher costs of labor and material, not to mention money, the National Electric Light Association could well afford to delve into the whole subject of rates with renewed vigor. In the case of smaller companies committees of men from the larger companies should be appointed to assist them with their rate problems. The building of scientific rate schedules requires intensive analyses of costs and conditions, and the problem is such a complex and vital one that it deserves the best thought of the association. Only experts should be intrusted with the work so that standardized schedules may become available for the different classes of service. Each of the various rate systems—that is, flat, straight, maximum-demand, tertiary, etc.—should have its standardized schedule forms.

*Mr. Central Station Operator or Electrical Manufacturer, are you likely to want to raise capital in the near future by the sale of stock or bonds? The amount of worthless or near-worthless securities for which ignorant people are exchanging hard-earned cash is enormous, and the diversion of capital to such follies will make it more difficult in time to get investment funds for legitimate enterprises.*

## Some Problems of Government Ownership

IT HAD been a foregone conclusion long before the United States entered the European struggle that if ever this country got into a serious war it would become necessary to take over, temporarily at least, the complete control of the railroads and perhaps of many other things theretofore privately owned and somewhat loosely regulated. No great nation can meet effectively the conditions imposed by war if it has to depend on the coöperation of conflicting private interests for its vitally necessary transportation; therefore it naturally came about that the federal government took over complete control of the railroads, and of many elements of production and distribution besides, as the only way of getting quick and efficient results. These in considerable measure it obtained, in spite of management often incompetent and recklessly extravagant. Now, however, the time has come when the exigencies of war have passed and the vital question arises of how far government control, not only of railroads but of other affairs ordinarily left to private enterprise, shall be continued.

This matter Philip Cabot considers in our columns this week in very illuminating fashion. It is true, as he states, that previous to the war the credit of many of our railroads under private management had been absolutely wrecked, often by methods of which the less said the better. The government took over a great group of practically bankrupt properties on a temporary

lien, put into them enough funds to rehabilitate them for its immediate use, and guaranteed returns upon them while it should be in control. As Mr. Cabot points out, the trouble now is how to let go of these properties. If the roads should now be turned back, most of them would stand a sorry chance of keeping out of the hands of a receiver. Mr. Cabot states that the way is not in the least evident, and his judgment is that the roads must continue under virtual government control as a natural evolution from the earlier periods of competition and monopoly. As to the competitive period, competition in transportation as in other large industrial matters has not existed within the memory of the present generation.

As Mr. Cabot puts it, "We had not competition but industrial war. . . . The unsuccessful competitor was killed and eaten by his adversary." The weakness of competition lay in the fact that there was not—and there is not yet—any proper criminal code against this murder and cannibalism. Until a corporation can be ruthlessly extinguished for industrial murder, through reecivership and a complete ousting of the criminals forever, competition will remain practically non-existent. Without entering into this phase of the matter, in vital things like transportation and public utilities generally there is certainly bound to be an increasing measure of government control. Electrical public utilities have long recognized this fact and are living under it with reasonable contentment. It seems to us that the line of demarcation established with reference to commissions and electrical enterprises is one which can be reasonably applied elsewhere, even in transportation. The commissions insist first of all that the consumer be treated fairly in the matter of price, a requirement which electric companies have generally lived up to with entire equanimity in spite of occasional injustice from the commissions. These also, by regulation of selling price and of capital increases, regulate the return permitted upon actual investments, and this return is not generally inadequate. The commissions were fortunate enough, to be sure, to get authority over electric supply at an earlier stage of its financial history than in the case of transportation systems, and thus have had less serious problems of capitalization.

On the other hand, the commissions have not had plenary powers in the matter of wages or hours of labor and have not in any way attempted to take charge of the internal administration of the operating companies. They have allowed interconnection and standardization of rates where such measures seem to be for the public benefit, have checked improper competition, and, by and large, have played the game pretty squarely. It does not seem necessary for either the public or the companies that government control should extend any further than this, and it is a little difficult to see why anything vastly more radical should be necessary in dealing with the railway situation. If adequate teeth had been given to the Interstate Commerce Commission, and claws at an early enough stage, it could have brought about a much better condition of affairs than existed at the time when the government had to take possession of the roads. Whether, now that the government has established an impossible wage scale with no protection to the country against further increase on penalty of disaster and starvation, the commission could bring order out of chaos without almost autocratic authority is somewhat doubtful.

## Power Factor with Unbalanced Loads

IF A SINGLE-PHASE system is supplied with single-frequency alternating voltage and current, then the ratio of the active power to the apparent power is not only the power factor of the system but it is also the cosine of the angle of phase displacement between current and voltage. This power factor is an instantaneous quantity in a system under varying load, unless otherwise defined.

If, however, one installs an active watt-hour meter, or ordinary watt-hour meter, to register the total electric energy released from the system, and also a reactive watt-hour meter to register the total electric energy which has moved to and fro in the system without being released therefrom, then the ratio of the reactive energy to the active energy in a given time is the tangent of the average angle of phase displacement between current and voltage during that time. The cosine of this average angle is accepted as the average power factor during that time. In this manner one may arrive at an accurate measurement of the hourly, daily, weekly or monthly power factor of the single-phase system. It is evident that the power factor may at some moments fall much below the average, and, if so, at other moments it must correspondingly rise above the average. In general, however, the daily, weekly or monthly average fairly represents the ratio of the useful or paying thermal load on the generators of the system to the total or gross thermal load which they have to carry during the corresponding interval. The heating of an alternator is substantially determined by the current that it delivers, whatever the power factor may be. An alternator of 1000 kva., for 1000 volts terminal emf., will be at least as fully loaded thermally when delivering 1000 amp. at 50 per cent power factor and 500 active kw. as when delivering 1000 amp. at 100 per cent power factor and 1000 active kw. It is true that on 50 per cent power factor the coal consumed per hour will be, roughly speaking, only 50 per cent of that consumed when working at 100 per cent power factor and delivering 1000 active kw., but, as far as using up the capacity of the electric generating plant is concerned, the 500 active kw. on 50 per cent power factor is as bad as 1000 active kw. on 100 per cent power factor.

In three-phase systems each phase of the system follows the same rules in regard to power factor as in a corresponding single-phase system. When the three-phase system is balanced, one phase only needs to be metered in order to determine the power and power factor of the system. In general, however, when the three-phase system is unbalanced, a double active watt-hour meter and also a double reactive watt-hour meter become necessary to determine the average power factor of the system as a whole.

In his article printed in the ELECTRICAL WORLD for Aug. 2, Willard S. Wilder shows how it is possible to connect an ordinary active watt-hour meter to any unbalanced three-phase system and obtain therefrom an accurate record of the reactive watt-hours. By following the plan outlined, the reactive watt-hours recorded are too few in the ratio of 0.866, the cosine of 30 deg.; so that the reactive record must be multiplied by the reciprocal of this quantity, or 1.1547. However, the windings of such a meter are readily capable of being adjusted in the factory so as to give the correct reactive watt-hour record. Mr. Wilder's

plan is well worthy of being followed in a number of instances where an average monthly power factor is desired to be measured.

*Efficiency engineering is in its infancy in the field of industrial-plant testing. The opportunity for original work in developing portable, flexible and standardized equipment and methods which will not interfere for a moment with production is just beginning to be appreciated by far-sighted technical men.*

## The Art of Load Dispatching

WHEN a supply system is in the early stages of its development, with a single generating station and a simple and homogeneous distribution, the load is readily handled by the station operator from the floor or gallery where the switchboard stands. He can in a moment see the condition of his load and operate the necessary switches on the required machines. As the system grows, the switchroom is divorced from the generating room and stations or substations become added centers of distribution, actual manipulation of the switching system rapidly gets out of the power of any individual and it becomes necessary to place the responsibility of direction upon one man whose subordinates attend to the actual details of operation.

A very good understanding of the practical situation is given elsewhere in Frank Gillooly's description of the evolution of the system operator's department in the Philadelphia Electric Company's system. Ten years ago the distribution had reached the point where the specialized efforts of a load dispatcher were necessary, and his work began. At present the system has grown in load nearly tenfold, and instead of two generating stations and a dozen substations, there are now ten generating plants, twenty-eight regulator substations—big and little—and forty-five industrial substations besides. To keep the whole in control, particularly in time of trouble, is a formidable strain on the nerves and memory of the load-dispatching staff, and the chief technical interest of the Philadelphia system here described lies in the artificial memory and record chart that has been provided. This suggests somewhat the plan often used in a complex railway yard, but it is somewhat simpler and more adaptable to the present purpose. Essentially it is a chart erected in three great panels, containing in symbolic form every bit of apparatus with which the operator is concerned. Wired in on this board is a complete system of signal lights, now some 800 in number, denoting every working piece of apparatus in service. These are operated from a keyboard in the load-dispatcher telephone exchange and serve to make a complete running record of everything that has been done and of the exact condition of the operating system at each moment. The instant visibility attained is a great improvement over any system previously tried. Not only has the load dispatcher complete telephonic communication with the stations and substations, including many of the industrial ones, but a telautograph system is also in use, furnishing a record of important communications. Altogether the equipment is most complete and has proved itself entirely convenient and efficient. It furnishes a good model to follow in organizing a load-dispatching system for a widespread and complex distribution.

## Feeder Regulation

SPEAKING in broad terms, there is no such thing as adequate service over anything but small areas attainable by mere increase of the conductors. All the possibilities in this line were tried out in the very early days of electric lighting and all were found wanting. Variations in load and shifting of the load center upset the most carefully devised measures for equalizing voltage. The advent of alternating-current distribution with its relatively high transmission voltage made in principle a change for the better, but in practice bad transformer regulation and loss in the secondaries still stood in the way of genuine improvement. The induction feeder regulator with voltage indication as for a distant point made for better service, since it was thus possible to carry through the regulation so as to take care by general average of transformer losses. It required the evolution of the alternating-current automatic induction regulator, taking care of the whole situation, to bring order out of chaos. The paper by Frank Hersey which we present this week will be found most illuminating as regards recent methods of regulation, especially as applied to polyphase distribution. It must not be supposed that even now regulation can be allowed to take care of itself, for careless installation of troublesome loads and bad feeder design still can overset good service; but despite this the judicious use of means now at hand enables a well-planned alternating-current distribution to give far better regulation than was ever dreamed of in the early days of the art.

Obviously there are plenty of cases in which more liberal use of copper is imperative, for over-much loss is costly and throws too heavy a burden on the regulators. A comparison of the total costs of copper versus regulator losses tells the initial story. Then comes the choice of regulators for use where desirable, and here enters the finesse of the engineer. Practically any kind of polyphase system, balanced or quite unbalanced, with uniform or variable power factor, can be kept in measurably good regulation by automatic devices of no great cost or complication in ways which Mr. Hersey discusses in some detail. In the last resort, however, final results from the economic standpoint depend on judicious design. No regulator, however good, can keep constant voltage at unsymmetrically related points, and none without auxiliaries now practically unused can take full account of the wandering of the load, which is an uncertain and generally unknown factor in distribution. Hence with the installation of automatic feeder regulators must come also very thorough study of the detailed conditions of distribution, the installation of new feeders, the reform of power-factor conditions, and better balancing of phases, if the best operating conditions are to be attained and maintained. Automatic regulation is a great gain, but no regulator can coördinate cause and effect. We are a long way yet from approximating the ideal in uniform distribution of voltage. Perhaps some day the opportunity will come in the complete reconstruction of a large system or the installation of a new one in a metropolis yet unbuilt. With such an opportunity will come the chance for the kind of distribution that is actually possible but now hindered by circumstances. The best that can generally be done under existing conditions is to deal with the situation as it is, using every artful device available to obtain the result.

# Radio-Telephone Development in Army

## New Method of Communication Was Successfully Used for Voice Command of an Airplane Squadron Within a Year of First Conference Concerning Its Feasibility—Story of This Achievement Shows What Problems Were Solved

BY LIEUT.-COL. NUGENT H. SLAUGHTER, CAPT. G. FRANCIS GRAY AND 1ST LIEUT. JOHN W. STOKES, SIGNAL CORPS, U. S. A.

GREAT interest has been manifested in recent months in the achievement of radio-telephonic communication on military airplanes. The primary object of this development has been to permit the voice command of airplane squadrons, and it may be said that this method of directing flight passed from the experimental to the practical state within the short interval of one year. Brigadier-General Squier called the first conference on the problem in May, 1917, and Colonel Culver directed the first squadron flight from the air in May, 1918. Among the problems successfully encountered were the production of a sound-proof helmet for the telephone receivers, a transmitter unresponsive to engine noise and a "filter" for the elimination of commutator notes. The combined apparatus must be light, compact and simple in operation. The antenna, moreover, should not hamper the acrobatic performance of combat planes.

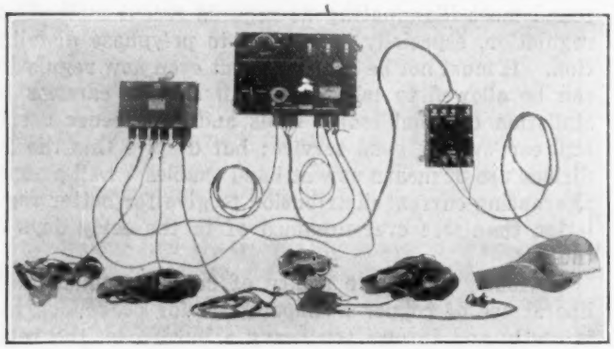

FIG. 1—COMPONENT PARTS OF AIRPLANE RADIO-TELEPHONE SET, SCR-68

It will be appreciated that in a departure so radical as the one under consideration a great many factors and a great many people are involved. In the present case the interest centers in three groups:

1. The Air Division of the Signal Corps, later separately organized as the Air Service, where the tactical use of airplanes and the training of personnel is considered.

2. The Signal Corps, which has to do with the development and provision of all means of communication for the army.

3. The various manufacturers whose facilities both for development and manufacture were of such great importance during the recent national emergency.

The accounts which have appeared to date on the subject of the airplane radio-telephone have each been written from the point of view of only one group and have in consequence laid stress upon only one or another of the three phases of the problem. The present article is written largely from the point of view of one of these contributors, the Signal Corps, and has to do with the development and procurement of the electrical apparatus.

The use of radio communication by the army has been enormously extended since the beginning of the war, an indication of its scope being given by a previous article in this series (see "Military Radio Communication," by Capt. A. D. Cameron, in the ELECTRICAL WORLD for March 15, 1919); but in practically all cases the telegraph rather than the telephone is used. There are good reasons for this, the principal one being that since it is possible for the enemy to intercept radio messages they are always sent in code, and for code use the telegraph is probably quicker and better than the telephone. Moreover, the power required for radio-telegraph sets is considerably less than that for radio-telephone sets over the same range. The one field in which it has been found that radio-telephony is distinctly superior is in the command of fleets of airplanes during maneuvers, and practically all of the development of radio-telephone sets has been directed toward supplying this class of equipment, although, of course, sets for use on the ground to communicate with planes equipped with radio-telephones have been necessary auxiliaries.

The story centers, therefore, entirely in the development of the airplane radio-telephone, and this article is in consequence confined to a historical and technical summary of the development of a new art, airplane radio-telephony, which has been improved and reduced to practice, and equipment supplied for use in the field, in a very short time, because of the urgent need of providing our troops with the most modern equipment. The elements of this art were previously known, but it passed from the theoretical and experimental into the practical stage only through the urgent war-time need for its application.

The extended use of groups of airplanes in warfare required the use of suitable apparatus for establishing communication between airplanes, and it was believed that the radio-telephone, if properly developed, would satisfy the requirements. Accordingly, shortly after the entry of the United States into the war the Chief Signal Officer undertook the development of a practical radio-telephone set for use on airplanes.

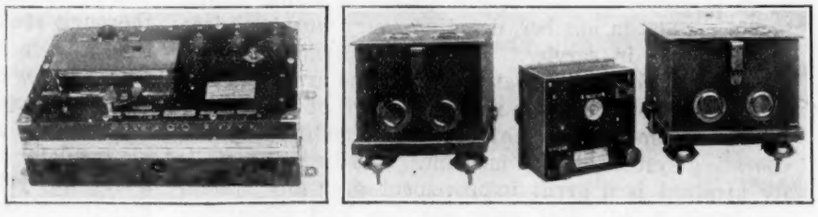

FIG. 2—SET BOX FIRST EMPLOYED (LEFT) AND LATER ARRANGEMENT
Set divided for convenient distribution of parts

No attempt will be made here to do more than suggest

the very considerable amount of work done by the various investigators prior to the war. Radio-telephony really begins with the use of the arc by Poulsen in 1903, but it was not until the invention of the three-element vacuum of 1909 that the construction of rea sonably small and satisfactory sets became possible. The advent of this device and its rapid development as an oscillator, modulator, detector and amplifier had revolutionized the radio art and resulted in a number of new developments in radio-telephony. Such companies as the Western Electric Company, General Electric Company and De Forest Radio Telephone & Telegraph Company had designed and constructed transmitting apparatus, employing vacuum tubes as oscillators and modulators, and receiving apparatus, employing vacuum tubes as detectors and amplifiers. Experimental results obtained from the apparatus were very encouraging when it is considered that the Western Electric Company succeeded in 1915 in establishing radio-telephone communication from Arlington, Va., to Honolulu, Hawaii, using vacuum tubes for all the functions above mentioned.

### APPLICATION OF TELEPHONY PRESENTS DIFFICULTIES

However, the application of radio-telephony to airplanes was considered difficult for the following reasons: (a) It had not been possible to develop a high-current microphone which would accurately reproduce the voice

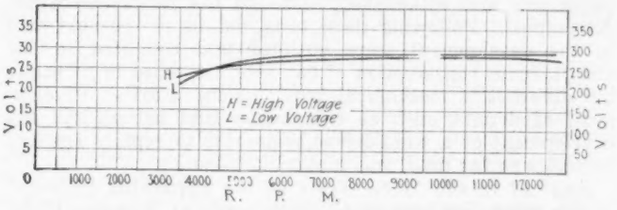


FIG. 3—VOLTAGE CHARACTERISTIC OF WIND-DRIVEN GENERATORS

and not be affected by engine and wind noise; (b) the inability completely to modulate the radiated energy greatly decreased the efficiency of the radio-telephone apparatus, and in order to obtain a satisfactory range of communication the weight would be objectionable.

The tactical uses of the airplane indicated that the radio-telephone, if successfully developed, would be especially applicable for communicating between planes and from plane to ground. Capt. C. C. Culver of the Signal Corps had been exceedingly active in the development of air radio and had formulated some very advanced ideas regarding the use of radio-telephony for voice-commanded flying. In August, 1915, while Colonel Reber was in charge of the aviation section of the Signal Corps, Captain Culver was detailed by War Department order to the aviation field at San Diego, Cal., with instructions to effect, if possible, a solution of the problem involving the use of radio on airplanes, with particular reference to the radio-telephone and its application to voice-commanded flights. The work and the interest which Captain Culver was able to arouse in this connection resulted in considerable development work along these lines.

In 1915 the De Forest company demonstrated a combined telephone and telegraph set for airplane use, and in 1916 the E. J. Simon Company made a radio-telephone with which the Signal Corps made some tests at San Diego. The Western Electric Company had also begun the thorough study of the subject with the object of applying its extensive knowledge of radio-telephony to this new problem of communication for airplanes.

In April, 1917, when this country entered the war, there thus existed in the minds of some persons, especially Captain Culver, a very complete understanding regarding the possibilities of using radio-telephony on

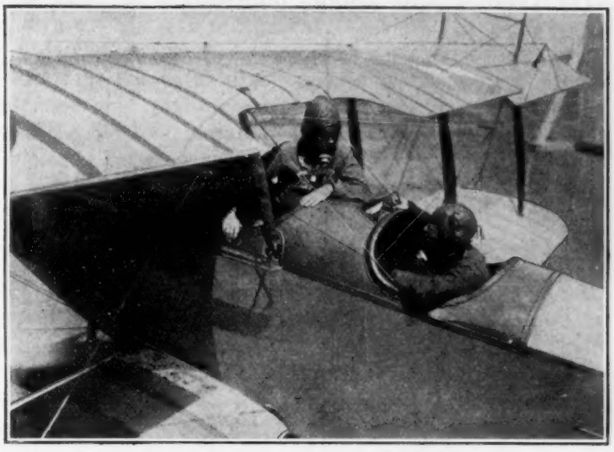

FIG. 4—AN INTERPHONE CONVERSATION DURING FLIGHT

airplanes. It was believed that the highest state of development would result in the establishing of voice communication between planes and from plane to ground and that the apparatus required would consist of fixed antennas, directly connected or wind-driven generators for power supply and light transmitting and receiving circuit apparatus, all of which would in no way interfere with the proper manipulation of the airplane.

The state of knowledge of the airplane radio-telephone art at the time the Signal Corps started active development may be summarized as follows:

(a) Comprehensive idea regarding previous history of radio-telephony.

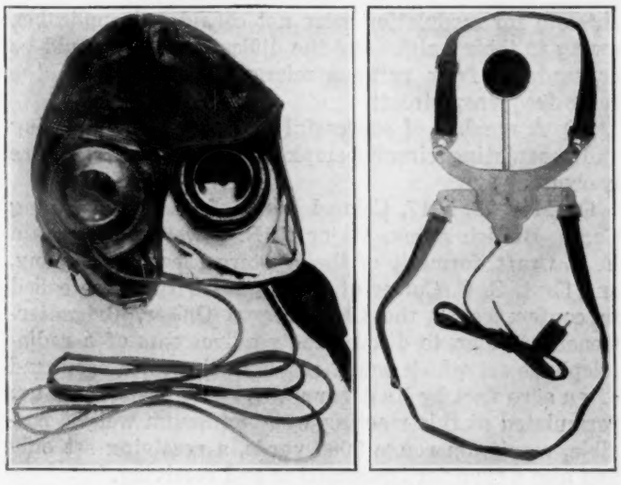

FIG. 5—AVIATOR'S SOUND-PROOF HELMET WITH HEAD SET AND TRANSMITTER

(b) General idea of air radio as employed by the Allies.

(c) Trailing wire antennas employing wires on framework of airplanes as counterpoise had been used for transmitting and receiving radio-telegraph signals on airplanes.

(d) Wind-driven generators had been used as power supply, but no scheme had as yet been proposed for maintaining good voltage regulation.

(e) The French army had developed an airplane radio-telephone set, but it had not proved entirely adaptable to front-line service.

(f) There was no definite information available regarding the range of communication desired or the output of a set to give a certain range.

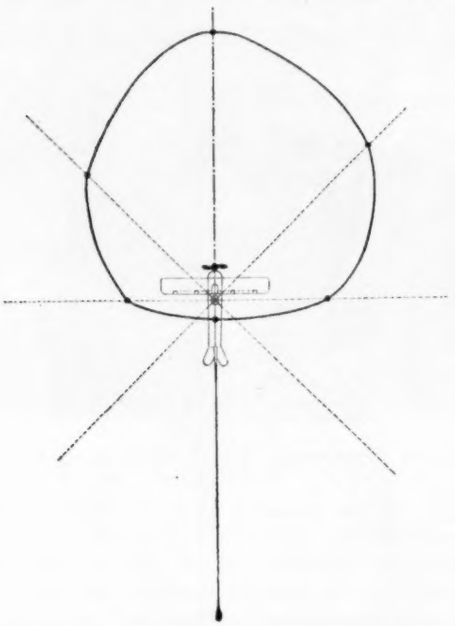

FIG. 6—DIRECTIONAL RADIATION CHARACTERISTIC OF ANTENNA

(g) There was very little information available regarding the range of speeds and the mechanics of different types of airplanes.

(h) Sets employing arcs, radio-frequency sparks, radio-frequency alternating-current generators for producing undamped waves and microphone in series with antenna for modulation were not considered applicable, owing to their weight and the difficulty which would be encountered from using a microphone directly in the radio-frequency circuit.

(i) A number of successful and practical oscillating and modulating circuits employing vacuum tubes were known.

On May 22, 1917, Colonel Reese of the Royal Flying Corps, British Army, Major F. B. Jewett and Captain E. B. Craft, formerly of the Western Electric Company, and Capt. C. C. Culver of the Signal Corps were called in conference by the Chief Signal Officer, Brigadier-General Squier, to discuss the requirements of a radio-telephone set which would result in the voice command of an aëro fleet by its commander. The basis of design formulated at this meeting was "minimum weight possible, maximum range 2000 yards, a receiving set only and also a type for transmitting and receiving."

It was generally understood that success would depend upon a satisfactory solution of the following problems:

(a) Development of an antenna system which would be an efficient radiator, would not be highly directive and would not interfere with the tactical manipulation of the plane.

(b) Development of a transmitter which would respond to the human voice but which would not be energized by the engine and wind noise.

(c) Development of a sound-proof helmet and receiver combination to exclude engine and wind noise.

(d) Development of transmitting and receiving circuits in which the control and adjustments would be simple and easy to make.

(e) Development of apparatus embodying the best combination of lightness and rigidity as required for use in airplanes.

(f) Development of vacuum tubes, small, rugged in design, of high efficiency, and which would be suitable for quantity production.

(g) Development of a power supply to fit the vacuum-tube design and which would not, either by its weight or head resistance, materially reduce the airplane performance efficiency.

(h) Coördination of all the above elements with the functions of the aviator and the airplane.

### CHRONOLOGY SUMMARY OF THE DEVELOPMENT

In order that a comprehensive picture of the rate at which this development was carried out may be gained, the following chronological outline is given:

*May 22, 1917.*—Conference called by General Squier to plan the development as above indicated.

*June 30 to July 5, 1917.*—First laboratory models of airplane radio-telephone sets tested at Langley Field, Va., by the Western Electric Company's engineers. Speech was successfully transmitted a distance of 3 miles (4.8 km.) from plane to ground, and communication from ground to plane was also established, although the ranges were not determined. Following these tests, details of the next step in the development were outlined and consisted in the simultaneous construction of two sets, the same in principle but different in mechanical construction. Further development of details, such as transmitter and helmet and the development of a wind-driven generator to replace the dry batteries so far used, was also undertaken.

*Aug. 13 to 24, 1917.*—Tests of the apparatus indicated in the preceding paragraph were made at Langley Field, Va. Sets operated satisfactorily, but wind-driven generator proved too noisy, owing to sparking at the commutator. Tests also indicated the requirement for vibration-proof tube supports and lighter construction. During these tests the interphone between pilot and observer was used, good two-way communication between plane and ground and between plane and plane was obtained, and the apparatus was demonstrated to the Secretary of War and foreign officers.

Following this test intensive development was undertaken to produce a mechanical design which it was hoped would be suitable for production, the improvement of the wind-driven generator to eliminate commutator noise, investigation of characteristics of trailing wire antennas of various kinds, further development and standardization of vacuum tubes, further refinement of detail parts.

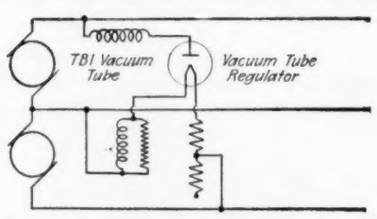


FIG. 7—CIRCUIT SHOWING CONNECTION OF REGULATOR TUBE

*Nov. 17, 1917.*—Airplane radio-telephone demonstrated by Western Electric engineers at South Field, Dayton, Ohio, for the benefit of army officers, officials of the Bureau of Aircraft Production and others. Successful conversation was carried on between plane and ground, using a loud-speaking receiver on the ground so that all could hear.

*Nov. 19 to 24, 1917.*—Airplane radio-telephone used for fire control experiments at Fort Monroe. The fire of a 12-in. (30-cm.) gun was directed at 17,000 yd. (15,544 m.). No difficulty was met with from the heavy gun fire, and the battery commander was at all times in direct telephonic communication with the observing airplane. It is interesting to note that after the shot was fired the battery commander had time to inform the plane by telephone well in advance of the landing of the shot. These tests were witnessed by a number of American and foreign officers.

*Dec. 2, 1917.*—Second demonstration was given at South Field, Dayton, Ohio, the loud-speaking receiver on the ground being equipped to interpret plane-to-plane conversation as well as to receive communications intended for the ground station. About 200 people witnessed this demonstration.

*Feb. 15, 1918.*—Preliminary production samples of type SCR-68 and SCR-67 sets were received.

*Feb. 20 to March 3, 1918.*—Daily flights were made at Langley Field, Va., to try out thoroughly the sets under service conditions. Wind-driven generator with proper filter was successfully used during these tests.

*March 3 to March 16, 1918.*—Extensive service tests at Gerstner Field, Lake Charles, La.

*April 1 to 27, 1918.*—Final series of service and life tests conducted at Langley Field, Va., and all minor details found defective reported to the Western Electric factory and corrected in the sets being manufactured in quantity. Some experiments on the use of higher amplification on the receiving sets indicated that interference from the ignition system of the airplane engine was to be expected under these conditions.

*May 1 to Aug. 1, 1918.*—Extensive life tests and service experience gained at radio laboratories, Camp Alfred Vail, where the sets were in regular use.

*May 11 to June 7, 1918.*—Series of experiments conducted by Western Electric engineers and army officers at Gerstner Field for the purpose of determining suitable antenna designs for use on planes expected to engage in voice-command acrobatic flying, also to study the use of the sets in voice-commanded flying.

*May 17, 1918.*—First successful voice-commanded flight made by Colonel Culver at Lake Charles. Thereafter trials and formation flying continued daily. Three groups of three squadrons each were organized for purposes of instruction and thorough demonstration of the practicability of the apparatus.

*June 1, 1918.*—Demonstration of formation flying using airplane radio-telephones was given to General Kenly and his staff at Gerstner Field. During this test the planes were controlled by airplane radio-telephone sets and the ground sets were so arranged that the spectators could listen to the messages. Various maneuvers, including an aërial battle, were carried out, and the practicability of this method of controlling airplane flights was demonstrated. At the end of this test each of the fliers in returning to earth performed in succession an Immelman turn, tail spin, side slip and steep spirals, during all of which their sets were in active operation, and of the thirty-nine ships only one had trouble with its antenna.

## DETAILS REGARDING SET DUE TO THIS DEVELOPMENT

In a complete production schedule there are naturally a number of sets closely related to each other, and the army has available for production a considerable number of radio-telephone sets. These first put into production, however, were all according to the same fundamental design and will be understood from a description of the airplane radio-telephone set, type SCR-68. A recent article by Messrs. Craft & Colpitts, of the Western Electric Company, appearing in the *Proceedings* of the American Institute of Electrical Engineers for March, 1919, covers the technical details of this set quite completely, and it is, therefore, desirable only to review the description of this equipment briefly.

The complete equipment of the airplane radio-telephone set, type SCR-68, is illustrated in Fig. 1. The control, transmitting and receiving equipment of this set are all assembled in a single unit, the set box shown in the center of Fig. 1. Provisions are made in this set for coördinating the interphone set, type SCR-57, with the radio equipment. The interphone set box is shown at the left of the radio set box in Fig. 1. A wind-driven generator employing a special voltage regulator tube serves as a source of power supply for both filament and plate circuits of the transmitting tubes and the filament circuit of the receiving tubes. A filter is placed between the generator and the circuits which it supplies to suppress commutator noise. The filter is shown at the right of the radio-set box in Fig. 1.

The set box containing the combined control, transmitting and receiving apparatus is illustrated in Fig. 2. The over-all dimensions of the set box are: Length, $17\frac{9}{16}$ in. (44.6 cm.); width, $6\frac{15}{16}$ in. (17.75 cm.), and height, $10\frac{7}{8}$ in. (27.6 cm.). This set box weighs 21 lb. (9.5 kg.). The circuit diagram of the wind-driven generator used with this set, using the regulator tube, and the voltage regulation obtained by the use of the tube are shown in Fig. 3. By use of the airplane radio interphone set, type SCR-57, the pilot and the observer are able to keep in communication. Fig. 5 shows the airplane radio transmitter and helmet used in the equipment of the SCR-68 set.

The antenna used for radio-telephone communication was a weighted trailing wire about 300 ft. (90 m.) long. The radiation characteristic of a trailing wire antenna, showing the directional effect, is illustrated in Fig. 6.

The SCR-68 set, with others of the same general design, having been put into production and a considerable amount of experience gained, it was found desirable to develop a new line of sets having certain modifications indicated by practice as desirable. The principal changes from the SCR-68 set to produce the new sets, known as SCR-91, were as follows:

(a) Subdivision of the set box into three parts so that the control equipment could be located at a point convenient to the operator without occupying too much space, the other equipment being located according to available space.

(b) The use of short wave lengths in order to reduce the likelihood of interference from other sets in use by the army, and also in order to make possible the use of shorter antennas, which was particularly desirable for combat planes where the long antenna often became entangled with the tail of the ship during maneuvers.

(c) Improvements in transmitter and helmet

(d) Modification of the interphone circuit to include side tone previously omitted.

The first experimental short-wave sets were completed by the Western Electric Company during the early part of June, 1918, and tested at Camp Alfred Vail, N. J.: The results from plane to ground were satisfactory, but interplane communication could not be maintained at sufficient distances. The practicability of employing short waves, however, was established, and it was decided to start development on more refined sets. The set resulting from this development, shown in Fig. 2, has demonstrated its ability to effect communication between planes at more than 5 miles (8 km.). Sufficiently extensive practical tests have not been made to indicate conclusively the relative merits of the SCR-68 and the SCR-91 type of sets.

# Selecting Voltage Regulators for Feeders

## Considerations Which Influence the Choice Between Heavy Line Copper and Lighter Copper Regulator Installation—Recommendations Regarding the Application of Single and Polyphase Regulators for Lighting and Power Loads

BY FRANK HERSEY *

IT IS frequently necessary to choose between voltage regulators to compensate for the voltage drop in the feeder and the installation of conductors of such size as to provide negligible drop. This choice depends on the relation between the annual cost of the line using the most economical conductor and the regulator, plus the cost of losses in the line and the regulator, and the annual cost of the feeder using the larger conductors to reduce line drop, plus the line losses. Consideration should also be given, however, to the fact that the regulator will compensate for the variations in supply voltage, which cannot be accomplished by the use of larger conductors. The installation of a regulator will oftentimes be more economical even if the total cost somewhat exceeds the cost of the heavier conductors.

The modern induction-type feeder regulator can be designed for controlling either single-phase or polyphase circuits. It can be operated indoors or outdoors. It can be self-cooled or artificially cooled, and it may be made for hand control, for remote control or for automatic operation. Automatically operated regulators present so many advantages over the other methods of operation that they are used almost exclusively at the present time, and for this reason only this type of regulator will be considered in discussing the application of voltage regulators for the control of distributing feeders, for outdoor installations and for substations tapping high-tension transmission lines. Inasmuch as the feeding system may be single-phase, quarter-phase, three-wire or four-wire, or three-phase, three-wire or four-wire, and as the conditions to be met in proper application of regulators differ slightly for each method of distribution, they will be considered separately.

### HEAVIER COPPER VERSUS REGULATOR INSTALLATION

To illustrate the problem of larger copper versus regulator installation assume that it is necessary to install a single-phase, 2300-volt, 75-amp. lighting feeder, the load to be equivalent to full load four hours per day 300 days per year. The most economical size of conductor would be No. 1 on the basis of fifteen years' life for the feeder, copper at 20 cents per pound; and, allowing 2 per cent for capital invested, 15 cents per pound for scrap copper, and energy to supply losses at $0.0125 per kilowatt-hour, as well as proper charges for erection and removal, the cost per mile of feeder would be approximately $184 and the drop would be 4 per cent. If not corrected, this drop, without considering the drop in the secondary distribution, would mean a reduction of over 12 per cent in candlepower of the lamps and a loss of over 6 per cent in revenue to the central station, or, on the basis of 10 cents per kilowatt-hour, the annual anticipated revenue of $21,000 would be reduced to $1,260. If larger-sized conductors were used to reduce the line drop, it would necessitate the installation of 350,000-circ.mil cable to maintain regulation within 1 per cent at the center of distribution, such as can be accomplished by installing a regulator. This would cost approximately $248 per mile. On the other hand, if No. 1 conductors and a regulator to compensate for the drop to the load center were used, the regulator, including the cost for losses and installation, would increase the cost of the feeder from $184 to $278. Unless the supply is subject to fluctuations such as occur in feeders tapped from transmission lines, making a regulator necessary, the lower cost favors the installation of the 350,000-circ.mil cable.

If, however, the feeder were 2 miles (3.2 km.) long, all other factors remaining unchanged, the full-load drop would be 8 per cent. To maintain regulation within 1 per cent of the load center without a regulator

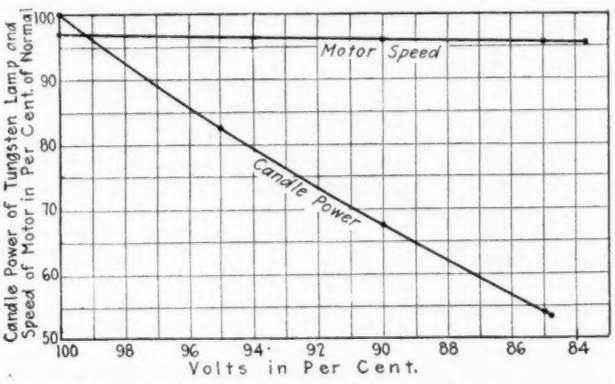


FIG. 1—EFFECT OF LOW VOLTAGE ON SQUIRREL-CAGE INDUCTION-MOTOR SPEED AND TUNGSTEN-LAMP CANDLEPOWER

would necessitate installing 1,500,000 circ.mil cable at a cost of $354 per mile, whereas the extension of the feeder would cut the charge for the regulator in half, making the cost to cover the installation of No. 1 conductors and regulator $231 per mile, or a difference of approximately 50 per cent in favor of the latter installation. If the feeder were 3 miles (4.8 km.) long, the saving in favor of the use of a regulator would be even more marked. In fact, the minimum cost is obtained when the entire range of the regulator is utilized in compensating for line drop. Inasmuch as the regulators selected would provide 10 per cent boost and 10 per cent lower, a total range of 20 per cent, the feeder could be extended for a distance of 5 miles (8 km.) and normal voltage would be maintained at the center, provided that the bus voltage was held constant at a value which would permit the regulator being in the neutral position when the load on the feeder was 50 per cent of maximum load. In other words, the regulator should lower the bus voltage 10 per cent at no load, 5 per cent at three-quarters load, and should raise it 10 per cent at full load. In this way the maximum benefit to be derived from the regulator can be obtained.

*From a paper presented before the transmission and distribution committee of the Ohio Electric Light Association.

The correct selection and installation of a voltage regulator involves many considerations which will now be discussed.

The automatic regulation of single-phase feeders presents no difficulties, however, since there is one definite point to be considered and the boosting or lowering of the regulator is directly added to or subtracted from the voltage of the feeder. If regulation to compensate for drop to some distant center is desired, one current transformer and a line-drop compensator must be included among the auxiliaries, whereas these accessories should be omitted if the regulator is merely to maintain the voltage constant at the station.

### VOLTAGE CORRECTION FOR THREE-PHASE FEEDERS

At times it may be desirable to regulate the lighting load on only one phase of a three-phase feeder. While under these circumstances one single-phase regulator would control the voltage satisfactorily, variations in power factor of the load would affect the phase relations of the currents from the current and potential transformers to such an extent that unsatisfactory compensation would be obtained unless two interconnected current transformers were used. In such an installation the regulator has its secondary winding in series with the line, while its primary is connected across the phase, so that at unity power factor the line current, and consequently the series transformer current, is displaced 30 deg. from the phase voltage, or to the corresponding secondary current of the potential transformer. If the load on the feeder is balanced and the power factor remains constant at approximate unity, satisfactory regulation can be obtained, as the line drop compensator can be set to counteract the error caused by the difference in phase relation of the currents from the current and potential transformers. Should the power factor vary considerably, however, and this is the prevailing condition, the phase displacement in the currents may become excessive. By using two current transformers interconnected, one in series with each leg of the regulated phase, a resultant current is obtained proportional to the current causing the drop, and it will bear the same relation to the potential transformer current as the line current bears to the phase voltage, so that correct compensation can be obtained irrespective of unbalancing in load or change in power factor.

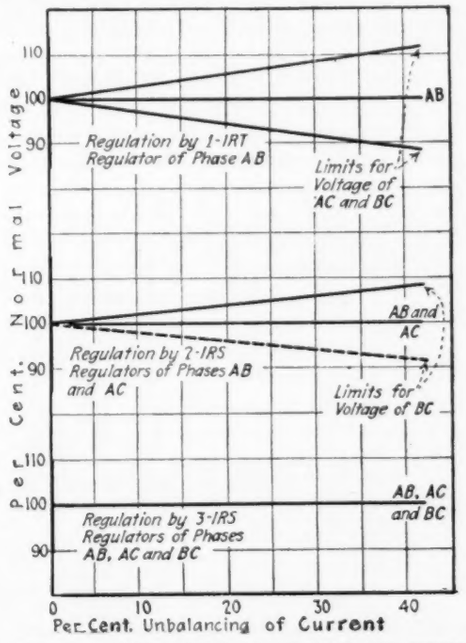


FIG. 2—USE OF SINGLE-PHASE REGULATORS ON THREE-PHASE FEEDERS

Three-phase feeder with $IR$ = 10 per cent and $IX$ = 10 per cent at normal load current. Load is (a) balanced with power factor, (b) unbalanced with power factor at 100 per cent. Curves show voltage at end of feeder at normal load current.

Where lighting is connected on only two phases of a three-phase system and motors are connected to the same feeder, two single-phase regulators and three interconnected current transformers should be used.

Where lighting and power are connected to all three-phase feeders, either one three-phase regulator, two single-phase regulators or three single--phase regulators may be used, depending on the balancing of the circuit.

The operation of any automatic induction regulators, whether single-phase or three-phase, is directly dependent on the contact-making voltmeter, which is a single-phase device. Consequently when a three-phase regulator is used the voltage on all three phases will be changed equally, the increase or decrease depending on the adjustment required by that phase across which the contact-making voltmeter is connected. When two single-phase regulators are used two of the phases will be adjusted independently and held at the desired value. The regulation of these two phases, however, will have a tendency to improve the voltage across the third or non-regulated phase, but the latter will be subject to variations under unbalanced conditions of load which cannot be entirely controlled. When three single-phase regulators are used the voltage on all of the phases will be maintained at the distributing center at a constant value regardless of the unbalancing.

Under balanced conditions of load the same regulation is obtained with a three-phase regulator as with either two or three single-phase regulators. This is due to the fact that with a balanced load the same adjustment of voltage will be required on all three phases with a change in load. With an unbalanced load, however, the voltage adjustments necessary to maintain a constant and equal voltage on all phases depend not only on the change in load but also on the unbalancing in current. For instance, assume that the load on the feeder is made up of a balanced three-phase motor load of approximately 85 per cent power factor and an unbalanced lighting load. The percentage of unbalancing is determined as the percentage which the maximum deviation from the average load on the three phases bears to the average. Then, under a condition of 15 per cent unbalancing, a variation of 4 per cent above and 4 per cent below normal might be obtained on the two non-regulated phases with the three-phase unit, while 3 per cent variation either above or below normal on the one non-regulated phase might result if two single-phase regulators were used.

In controlling a three-phase, three-wire feeder there are no conditions of operation under which the use of two single-phase regulators will not result in regulation as good as or better than can be obtained by the use of one three-phase unit. Furthermore, if the unbalancing becomes excessive, it will only be necessary to install the third single-phase regulator in order to obtain satisfactory regulation if two single-phase regulators are installed, whereas it would be necessary to replace the three-phase unit with three single-phase units at a very much greater increase in cost. The single-phase regulators also have the advantage that they are more

flexible in that the same regulators can be used without change if the system is changed from three-wire to four-wire grounded-neutral distribution. The only advantages of the three-phase regulators are the smaller floor space required and that so much inspection is not necessary since only one set of auxiliaries have to be inspected. In general, the cost and efficiency for two single-phase regulators are about the same as for the three-phase unit.

Three-phase, four-wire feeders are in quite common use, the fourth wire being grounded. For such systems three single-phase regulators should be used, the secondaries being connected in series with a phase wire and the primaries excited from phase wire to neutral. Very satisfactory regulation can be obtained by using this method, as it is practically equivalent to three independent single-phase feeders. If the load is unbalanced, however, current will flow in the grounded wire and an additional line-drop compensator and current transformer will be required to provide compensation for drop in this wire.

Two-phase systems may be three-wire or four-wire. In the case of a four-wire distribution system correct regulation can be obtained by using a two-phase regulator if the load is balanced. In three-wire distribution, however, for either balanced or unbalanced conditions of load, or if the load is unbalanced in the four-wire distribution, two single-phase regulators should be used, as each phase will then be controlled independently and close regulation can be maintained. If a two-phase unit were installed, the non-regulated phase would be subject to variations since the line drop in the regulated phase affects the voltage of the other phase and no means can be provided for correcting this condition.

### Advantages of Installing Regulators Outdoors

When laying out a feeder system consideration should be given in selecting the size of conductor to the probable future demand rather than merely the installation of a feeder that would take care of the existing demand. Unfortunately, communities do not always expand as expected, some sections building up compactly and steadily while others are irregular in their growth or spread over a greater area than originally contemplated when the feeders were installed. It would be uneconomical to replace or reinforce the present lines or to install additional feeders for the sparsely settled sections of the community, or for sections where the growth has been irregular, as long as the maximum loads on these feeders are considerably below normal. At the same time, the voltage conditions on the feeder as a whole may be far from being satisfactory from the standpoints of both service and anticipated revenue. The only solution of the problem is to establish two or more load centers, each being supplied from the main feeder but having the voltage maintained at normal regardless of variations on the main feeder. This can be accomplished by the installation of induction regulators designed for outdoor service. Usually these regulators are installed at the load center, making it unnecessary to provide auxiliaries to compensate for additional line drop, although the regulator may be installed at a point distant from the center if this is desirable and arranged to compensate for the drop by employing the usual accessories in the same manner as with the station regulators.

This type of regulator is also well adapted for controlling the lighting circuit of an industrial plant supplied with energy from a feeder used primarily for the distribution of power and therefore probably not regulated at the station. A change in voltage does not materially affect the speed of the average motor, but it is detrimental to illumination, affecting not only the quality of the product manufactured but the output of the plant and also the safety of the operator.

### Voltage Regulation of Substations

During the past decade remarkable strides have been made in the distribution of energy at high voltages over great distances from points where power can be generated more economically and more efficiently. Numerous small generating stations, heretofore entirely isolated, have been tied together, the less efficient generating equipment in many cases being dismantled and the station converted into a substation, or replaced by an outdoor substation, for the transformation of energy from the transmission voltage to a voltage suitable for local distribution. In order to provide voltage regulation for the local system comparable to that obtained from the original generating equipment with its generator voltage regulator, it is necessary to install induction regulators, either indoor or outdoor, as the need for regulation has not been eliminated by the change. If anything, the need has been accentuated, as the line drop on the local system is unchanged and in addition the transmission line is subject to variations which will be impressed on the feeding system if no provision is made to maintain the voltage at normal. In an installation of this kind a regulator will perform the double function of correcting variations in the supply voltage and also compensating for drop in the distributing feeder.

In this case voltage regulation of the feeding system not only results in improving the service to the consumer and increasing the revenue to the operating company, but also makes possible the installation of more economical equipment for the generation and distribution of power. Voltage regulation closes the gap between the efficient power plant and the equally efficient appliances in the household, thereby enabling the utility company to carry efficiency through to the consumer.

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IN REVIEWING the past twenty years' history of this question I cannot escape the conclusion that we electrical men, and not our steam road colleagues, are responsible for the slow progress made. We have not known enough about either the science or the art of railroading. Our belief in and our zeal for our own profession has led us, albeit with entire honesty of purpose, to make more or less extravagant claims as to what we could do and to underestimate the cost of doing it. The inevitable reaction of mind which followed an accurate determination of facts of course disturbed confidence in our judgment. But if at times we have injured the cause of electrification by claiming too much, strange as it may sound, we have injured it a great deal more by not claiming enough. Electrical engineers, not having always been railroad men, have been unable to study railroad problems as they should have been studied, that is to say with only real and not with any arbitrary limitations before them.—*Calvert Townley.*

# Reinforcing System Operator's Memory

## Evolution of System Operator's Duties in Philadelphia Electric Company's Plant—Description of Electric Chart Used in Load-Dispatching System—Reasons that Influenced the Company in Adopting It

BY FRANK GILLOOLY

NEARLY ten years ago, when the office of system operator was established by the Philadelphia Electric Company, this operator was given control of an area of approximately 60 square miles (153 sq.km.) with a capacity of 38,000 kw. in its two generating stations, a peak load of 30,000 kw. and a yearly output of 76,000,000 kw.-hr. To-day his successor, the load dispatcher, handles many times the original amount of detail on the system, now grown to embrace an area of 245 square miles (627 sq.km.) covered by 3650 miles (5870 km.) of lines, with a generating capacity of 240,000 kva., a peak load of 190,000 kva. and a yearly output of nearly 700,000,000 kw.-hr. During all these changes and additions in equipment some means of reinforcing the system operator's memory as to the make-up of his system was necessary, and a dispatch chart was devised that showed the layout of the whole system.

The system operator's office was first given the

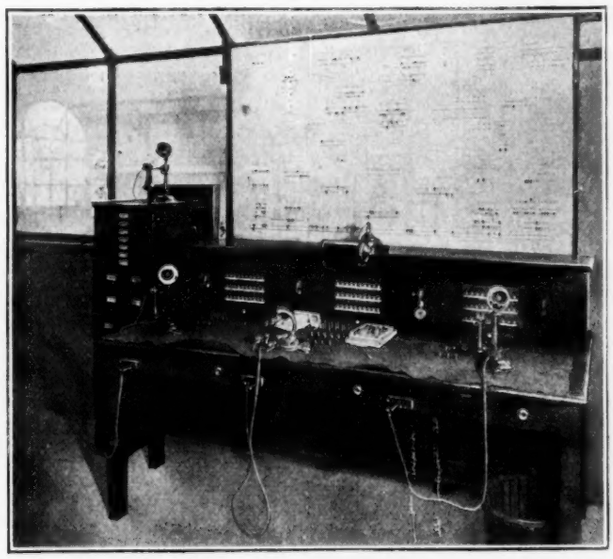

FIG. 1—FIRST OFFICE OF PHILADELPHIA SYSTEM OPERATOR

operation of the system controlled by the generating department, which embraced two generating stations and twelve substations and served a territory 10 miles (16 km.) long and 6 miles (9.7 km.) wide, over 115 miles (185 km.) of transmission lines. Four of the twelve substations served the Edison district; in them the system operator's jurisdiction ended at the high-tension busbars. The other eight were transformer substations; there his control was extended to the point where the 2400-volt circuits left the station.

There was only one frequency, one transmission voltage and one distribution voltage. The company carried no railway load. The 250-volt direct-current system was under the Edison department. Street-lighting fell to still another department. All company activities in each of the outlying districts were controlled by the department formed within that district.

The system operator was stationed in the operating room of the main station, now the Schuylkill-1 station. Fig. 1 is a view of his first office. For his guidance, in addition to the switchboard instruments that showed the load carried on his station apparatus and outgoing feeders, he had the dispatch chart giving the layout of his system. A telephone exchange with direct wires to all the stations controlled by him, together with a filing cabinet for his blueprints and records, completed his equipment. The dispatch chart was a map, 72 in. by 36 in. (183 cm. by 91 cm.), giving in single-line diagram the layout of each station with the lines connecting the stations. This was hung above his telephone desk. The switch of each piece of apparatus was represented by a hook on which was hung a metal tag that denoted whether the switch was open, closed or blocked out of service, thus showing the status of all apparatus. The map was drawn in black ink on white paper, glued to the board and shellacked.

### PROBLEMS OF THE SYSTEM OPERATOR

The system operator's duties multiplied. The generating department was made the operating department and given control of the entire generating and transmission systems. Meanwhile railway load had been taken on, transmission changed to 13,200 volts, three-phase; existing stations remodeled, new ones built, and industrial substations established. Two generating stations under the system operator's jurisdiction increased to ten, twelve substations became twenty-eight, and forty-five industrial substations were connected to the company's lines.

Besides his responsibility for the operation of the system, the system operator was chief operator of his own station, having as assistant a first-class switchboard operator. During trouble both his station and the system demanded his attention. If he devoted himself to his station, the substations awaited his directions and their interruptions were prolonged; if he remained at his telephone directing the outside switching, his station was in the hands of his operator, for whose moves he was responsible.

When it was decided to divorce the system operator from the actual operating of the generating station, the question of his location arose. When there was only one main station his logical headquarters was at that point, but with several such stations on the system no advantage would be derived from locating him in any one of them. Various sites were considered until it was decided to locate him in the main office building, away from the excitement of station operating. A room adjoining the company's telephone exchange was chosen because of the advantages it offered in short and simplified telephone connections and in an auxiliary telephone system in case of accident to his equipment.

In 1915 the system operator became the load dispatcher, when his place in the generating station was assumed by the chief operator. During the moving duplicate telephone equipment was maintained at the old and new sites, and dispatching was accomplished from both. The day shift first was operated from the new location. After a week of this experiment the evening shift was moved; in another week the night shift was transferred, when all ties with the generating station's direct operation were severed.

The operation of the system had become too great a burden for one man on a shift. New men were trained and the personnel was increased until at present it includes a chief dispatcher, three dispatchers and three assistant dispatchers. The system to-day comprises distribution of 250-volt commercial and 600-volt railway direct current and 2400-volt, two-phase and four-phase, 60-cycle alternating current; transmission of 66,000-volt, three-phase, 60-cycle, 13,200-volt, three-phase, 25-cycle and 60-cycle, and 6000-volt, two-phase, 60-cycle alternating current, as well as alternating-current and direct-current series street lighting.

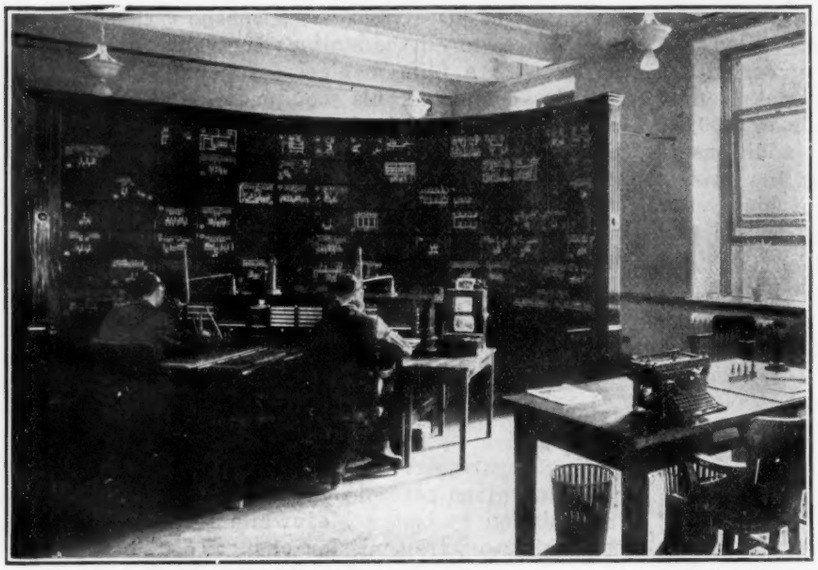

FIG. 2—NEW ACCOMMODATIONS FOR PHILADELPHIA LOAD DISPATCHER, SHOWING ELECTRIC DISPATCH CHART

The load-dispatching system of the Philadelphia Electric Company is a comprehensive one. The load dispatcher's activities commence at the generating-station boilers, embrace the generating units with their auxiliaries, traverse the transmission lines, include the substation and its apparatus, and end out on the distribution circuits. The load dispatcher is responsible at every moment for the generation, transmission and distribution of the proper amount of load. He computes the demand to be met, schedules it on his generating stations, ascertains that each station will have sufficient steam and electrical capacity to carry the load and that there will be reserve equipment on the system to compensate for the loss of the largest unit running. To do this he must know generally the load required by each substation and distribution circuit, for which purpose he maintains an extensive system of records. No switching is done without his direction, except that done according to standardized instructions to restore service in an interruption or in case of emergency. Before any unit is started or stopped he is called. No apparatus is worked on without a permit from him. He is responsible for all blocking, and for the testing of new and repaired equipment.

The first dispatch chart given the load dispatcher was similar to but larger than the one used by him as system operator. It consisted of three sections representing the three geographic divisions of the company. The largest, the central district, measured 42 in. by 80 in. (107 cm. by 203 cm.), and occupied the middle section. The northern and southern districts were on sections 42 in. by 24 in. (107 cm. by 61 cm.), hinged at either end of the main board.

Each change in apparatus on the system entailed a corresponding correction on the dispatch-chart drawing that meant scraping off the varnish, inking in the correction and revarnishing. The old ink was paler than the new, the map paper suffered from the scraping, the new varnish never matched the old; so that each change marred the appearance of the chart. Cable rerouting involved a tedious change; for if the entire section of cable affected was not removed, a collection of loose ends of lines accumulated on the map.

The hook-and-tag type of chart had proved unfavorable. In time of trouble so much switching was done that the dispatcher could not get to the chart to correct his layout, and with two men working neither could know the other's moves unless he delayed to question him or the station men. The man who had made a change could generally recall it, but another man had no way of knowing that the outlay shown was not correct. The dispatcher must always know the switching layout, and for two men to work properly together each change should immediately be shown. Even with a man detailed at the chart to take care of the switching done, time would be lost in explaining the moves to him.

All the disadvantages of the manually operated and the unit types of chart had been experienced, and plans were made for a new board that would be both sectional and remote-controlled. The new electric chart is the outcome of these plans. Its design is the combined ideas of the many men concerned in its operation.

### THE NEW ELECTRIC CHART

The present load dispatcher's office is shown in Fig. 2. The electric chart went into operation on May 19, 1919. Plans for it were begun in 1914, but its construction was hampered by the war. It is made of steel panels, 11 in. by 16 in. (28 cm. by 41 cm.) and $\frac{1}{8}$ in. (3 mm.) thick. The panels are finished in a dull dark-green baked-on enamel that agreeably contrasts with the white markings. The present equipment comprises 105 panels. Each station has its separate panel or set of panels, as shown in Fig. 3, and the stations are arranged both geographically and according to the class of service supplied. The woodwork of the chart, including the molding sur-

rounding the panels of each station, is of mahogany finish. The board is crescent-shaped, 20 ft. (6 m.) long and almost 10 ft. (3 m.) high. The upper panels are reached from a platform 16 in. (41 cm.) wide and 28 in. (71 cm.) high, its top finished in green linoleum to match the panels. In the front of the cabinet formed

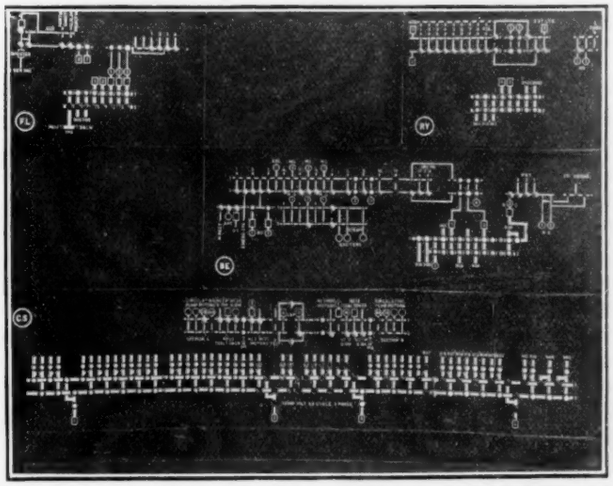

FIG. 3—SECTION OF ELECTRIC DISPATCH CHART

At the Chester station (CS)—each station name is abbreviated to two letters inserted in a circle—No. 4 unit is shown blocked out of service by red bulls'-eyes, as is a section of No. 1 13,000-volt bus and No. 907 feeder. On the 2400-volt station-power bus round red plugs show that No. 4-A and No. 4-B circulating pump motors, No. 1 converter and the test feeder are blocked. Sectionalizing "disconnects" are shown closed by flat white plugs in both buses. Pole-line "disconnects" on either side of the No. 1115 feeder tap into Folsom station—Symbol FL—are shown closed by flat brass plugs. Round white plugs denote various secondary apparatus on the line at different stations, but the lamps that are lighted cannot be distinguished in the picture above.

by this platform are hinged doors giving access to the fuses housed within.

All the apparatus with which the load dispatcher is concerned is shown on the chart. Feeder routes are not shown because they complicate rather than simplify the map. The drawing is in white celluloid cemented to the panel. Circuit breakers are represented by lamps; air-break disconnecting switches and the switches of distribution circuits are represented by special metal plugs fitting holes in the panel, rather than by lamps, since their switching ordinarily is not of prime importance to the load dispatcher. All apparatus is plainly numbered or named. As may be seen from Fig. 3, various symbols represent different types of apparatus—a circle for rotating apparatus, a square for transformers, a circle and square for rotating apparatus connected through a transformer, a rectangle for turbo-alternators.

When the apparatus is alive the lamp on it is lighted; when the apparatus is dead the lamp is similarly dead. Green bulls'-eyes are for normal operation—the green creating less eye strain than white—and red bulls'-eyes are for blocked-out equipment. The plug used for disconnecting switches has a thin, flat top. White plugs are for station switches, brass plugs for pole-line switches. On other station switches than "disconnects" a round white plug is used. The plugs are in place only while the apparatus is on the line or blocked out of service. White or brass plugs are for normal operation, red plugs for blocked apparatus.

The lamps are controlled from a keyboard on the load dispatcher's telephone exchange. They are type 2-U telephone signal lamps, operating on 24 volts, with an average current of 0.041 amp. The keyboard, shown in Fig. 4, contains 1520 pull-button type single-pole switches, likewise standard telephone equipment. The switch is down, or in, when closed and its contacts are installed inside the keyboard. The keyboard occupies the entire middle position of the exchange. There are 100 switches on the vertical section, and 1420 on the horizontal part, which is extended 32 in. (81 cm.) beyond the rest of the board to a total depth of 52 in. (132 cm.)

### WIRING OF KEYBOARD AND LAMP FRAMES

The keyboard and lamp frames are laid out in the fashion typical of modern telephone-exchange construction. The positive side of the supply current is carried to the lamp-fuse panel under the platform of the chart, where the feed wire (No. 18) for each group of twenty lamps is fused. The negative supply—which is grounded, to conform to telephone practice—is connected to a similar fuse panel in the back of the telephone desk, where the lamp switches are similarly fused in groups of twenty. From the switches No. 22 silk-and-cotton-covered wires in 100-pair lead-covered cables travel through conduit in the floor to receiving terminal blocks, near the fuse panel in the cabinet at the base of the chart. Single-conductor jumpers of No. 20 rubber-covered braided wire connect these blocks with the lamp terminal blocks in the back of the chart. No. 22 silk-and-cotton-wrapped wires are carried in thirty-pair cables up the iron structure of the chart to the station panels. and there fanned out to the lamps, forming the third link in the switch-to-lamp circuit. The fuse is rated

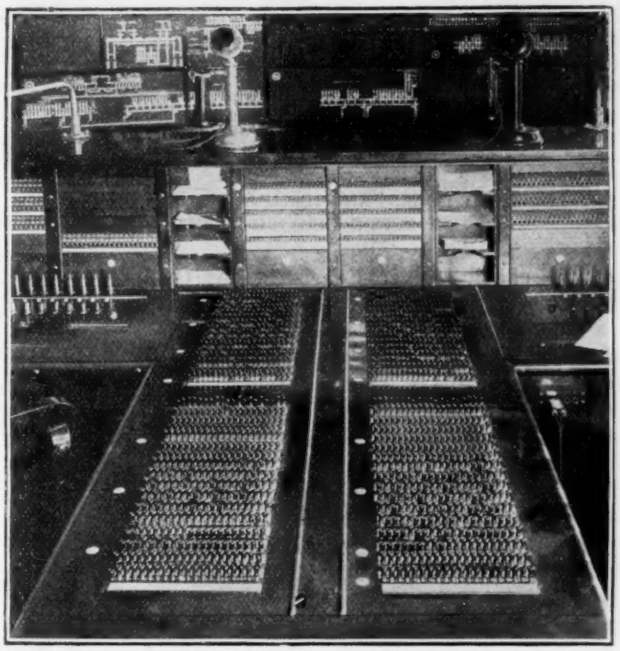

FIG. 4—KEYBOARD CONTROLLING DISPATCH CHART SIGNAL LAMPS

at 1½ amp. and is the "grasshopper" style of telephone alarm fuse that throws itself open on blowing and energizes a bell-alarm circuit. Fig. 5 shows the connections of the lamp frames and lamp terminal blocks. The heavy brass lamp sockets are supported from fiber blocks on the steel panels through which they

protrude to bring the bulls'-eyes flush with the panel faces.

The dispatch-chart structure and all its power-supply equipment were installed by the Philadelphia Electric Company. The panels were made by the Electrical Development & Machine Company, and the celluloid drawings were made on them by the Philadelphia Electric Company. The whole telephone table was built by the Western Electric Company. Both it and the chart were wired by the Bell Telephone Company.

The lamps are connected in parallel, each through its own switch. There are 800 lamps now connected on the chart, 600 of them normally in use, taking a total current of 24 amp. Energy is normally obtained from a 3-kw. General Electric direct-current motor-generator in the basement engine room of the building and controlled from the power board back of the chart. Emergency services are from a 120-amp.-hr. twelve-cell "Exide" storage battery, situated in back

FIG. 5—LAMP FRAMES AND TERMINAL BLOCKS AT BACK OF ELECTRIC DISPATCH CHART

of the chart, and from a 3000-watt General Electric 240/24-volt transformer, mounted on the power board.

The load dispatcher's telephone exchange is placed diagonally in the room facing the dispatch chart, with a radius of 10 ft. (3 m.) from the operator to the chart. The exchange is a three-position Western Electric PBX board. The first and third are the operating positions, with the keyboard for the lamps between them within reach of either operator. Each position has two panels with a capacity of 160 stations. The positions are multiplied, and are equipped with "calling" and "busy" pilot lamps. There are ten cords to the position. Switching keys are provided for cutting the positions in half, giving the board four operating positions. The bracketed transmitter and the headband receiver may be connected to either half of a split position through a two-way jack, from which also a second operator's set may be cut in on a whole or half position.

The exchange is used exclusively for dispatching. Direct wires connect with the switchboards of all company stations, the largest industrial substations and the trouble department. Three tie lines go to the company's regular exchange and two trunks to "central." Telephones connected to "central" are maintained for dispatching purposes in most high-tension consumers' substations. Telephones of the Keystone system, a system independent of the Bell system, on which this exchange operates, are also provided for the dispatcher.

### OFFICE OF THE LOAD DISPATCHER

The load dispatcher's office is a bright room, 22 ft. (6.7 m.) by 35 ft. (10.7 m.). Indirect illumination is obtained from six inverted frosted bowls containing 150-watt type C lamps. Each bowl has attached a direct fixture containing one 25-watt, 35-volt tungsten lamp for emergency lighting. Lighting is normally taken from the direct-current mains of the building, but throw-over switching is provided to a special alternating-current service. The emergency lighting, which also serves the telephone and trouble department rooms adjoining the load dispatcher on either side, is fed from the storage-battery supply for the chart. The furniture includes a chief dispatcher's desk, a four-place clerk's table, card-index and ledger filing cabinets, a wardrobe, and typewriter and telautograph tables. The telautograph is beside the dispatcher and connects with the instrument in the operating engineer's office. An Edison dictaphone is provided for the recording of various reports.

Aside from the facility the dispatch chart affords of inserting a complete new station or altering an existing one without marring its appearance or affecting its operation, the chart's advantages are many. With a moment's work the dispatcher has merely to touch a key or two to show an added unit on the line, a feeder that has tripped, a station that has shut down. In time of trouble, when rapid switching is necessary and there is no moment to lose in discussing the units that are on or how they are on, each operation can be flashed on the chart while the dispatcher is ordering it or learning of it, and the record is there, for himself, the man who is working with him and any one else who understands the operation of the system.

Only for switching on secondary apparatus or for blocking and what is equivalent to blocking, the operating of disconnecting switches, does the dispatcher have to leave his chair and go to the chart. All else is done at the touch of a button.

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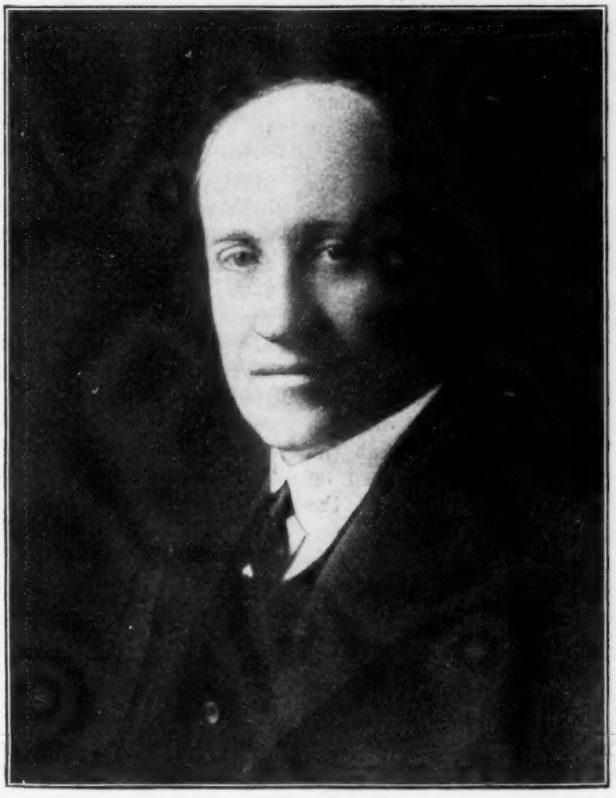
THE natural training school in the electric lighting industry is the company section of the National Electric Light Association. The utility and effectiveness of these organizations throughout the country have been so clearly demonstrated as to make comment unnecessary. I am convinced that in the coming years our executives and the leaders in our industry must of necessity come through the avenue of the local company section of the N. E. L. A. I know of no other spare-time activity to which an employee of a central station may devote his time which promises so much in the way of individual betterment and advancement in the business as active membership in a company section.—*Joseph B. McCall.*

# Government Operation of Public Utilities

## Competition in Power Field Essential to Health of Electric Utilities, Otherwise Fate of the Railroads and Street Railways of the Country Will Also Engulf the Central Stations

BY PHILIP CABOT
Partner in White, Weld & Company, Boston, Mass.

IN DISCUSSIONS of the subject of public utilities it has been customary to use the phrase "government ownership" to cover both the ownership and the operation of the properties, it being very naturally assumed that government ownership would come first and government operation follow as a matter of course. In the case of the railroads, however, the exigencies of war forced the government to reverse this procedure by taking operating control on Jan. 1, 1918, but without any change of ownership; and as a result of eighteen months' experience it is now becoming clear that the most vital questions connected with the relations of the government to the utilities are questions of operation rather than ownership. To economists and to a certain limited class of investors it may be a question of great importance whether the money needed to finance these undertakings is subscribed directly by private individuals or indirectly through the purchase of a government bond. But such persons do not constitute a large or important class. The question of operation, however, touches us all; the service rendered and the cost of it come home to everybody, and this, therefore, would seem to be the proper starting point for present discussion of the subject.



PHILIP CABOT
Founder of Turners Falls Power & Electric Company; Public Utility Builder and Financier

The last four years have provided the nation with an extraordinary chance to gather experience upon the question, and more progress should have been made toward its solution by crystallizing the evidence in the mind of the average man than during the preceding decade. The economic upheaval of the war forced the government not only to take over the operation of the railroads but to regulate and control the business of the country in practically every important field—a departure from our traditional policy which might have ended in disaster had not the government called to its aid the most remarkable group of business men commandeered from private life that was probably ever got together. These men, working with utter loyalty and self-sacrifice, produced results which, if disappointing, were far better than could have been expected and far better than could have been attained under normal peace conditions.

A four years' trial of the experiment, however, appears to have produced an overwhelming demand from all parts of the country for a return to the pre-war conditions of private control and free competition.

In the field of so-called public utilities the railroads have furnished a most illuminating example, bringing into clear relief many aspects of the problem of government control which were before obscure to us—among others the important fact that there is a logical and necessary sequence from what was called competition in this business to combination and monopoly, thence to government regulation, with actual government operation as the final result. It will be instructive to follow this process in the railroad field and see what can be learned from it.

On Jan. 1, 1918, the federal government took over operating control of the railroads of the nation as a measure of war, and we have had a year and a half's experience (albeit under abnormal conditions) of how it works. But long prior to that time it had become so obvious that the credit of the railroads was breaking down that in 1916 Congress began an investigation of the subject. For two years this investigation has been going on, the evidence, plans and arguments submitted filling three bulky volumes of more than 4000 pages. This is now the Bible of the subject for this nation, and no commentator can expect a hearing who is unfamiliar with it.

The immediate point which Congress must decide in regard to the railroads is what to do with them. The federal government has got them and is in much the position of the gentleman who had the wolf by the ears and needed help to let him go. How to do it has been suggested to the Senate committee on interstate commerce in at least fourteen complete and

different ways, and innumerable partial solutions have been offered. These plans, and in fact all the evidence submitted to the committee, show that the nation's experience with government operation has produced general and strong reaction, finding utterance in a nation-wide demand that it should now stop and that the railroads should be returned to private operation. But here a strange phenomenon appears. No plan has been suggested (or apparently discovered) by which this demand can be made effective.

### REGULATION MUST GO ON

All the experts agree that the business is of so fundamental and essential a character that government regulation must go on. Freight service and freight rates are the lifeblood of the nation. Bad service or high rates can ruin an industry or starve a community. Cities can be developed and great movements of population forced through rate control. These are social, not business, problems which the public through its general government must decide.

And again the experts agree that the question of railroad wages and working conditions is so important, and that the railroad unions have become so powerful, that the federal government alone can exercise effective control; in short, that the federal government must fix wage scales and hours of service and arbitrate labor disputes.

And, lastly, the experts agree that even before the war the credit of the railroads had fallen to a point where they could not induce private capital to finance current extensions, so that government assistance in this respect was imperative.

See what necessarily follows from these conclusions: Government control of rates means government control of gross earnings; government control of wages and working conditions (as wages take 60 cents out of every dollar of operating cost) means control of operating cost; and, as it is generally agreed that the government must either guarantee a fair return on railroad investments or provide the money needed, the government will control the net income. This is practically the unanimous judgment of the men in this country who favor so-called "private ownership and operation" and are best qualified to judge. Now you may call that condition "private ownership and operation" if you choose (just as you may misuse words at your pleasure in a free country), but it isn't. It is government operation in fact and in effect, and if the opinions of the experts are of any value there appears to be no alternative.

### WEAKNESS OF GOVERNMENT CONTROL

These same men testify that private control of operation and a substantial measure of competition are essential to efficiency and economy. The experts state, and apparently prove, that high operating efficiency and low rates have never been attained by government operation; that no government railroads in the world have ever succeeded in these ways, the stimulant of competition, of private venture and private profit being necessary to spur men to their highest effort. Government operation appears to destroy ambition and the motives for energetic action by producing an atmosphere of stagnating monotony which capable men, who demand a future, cannot breathe. This is not the atmosphere in which the people of this nation want their railroads run—they sincerely want the conditions of private business, where competition has free play. But the fact appears to be that they just cannot have it. No practical method of reaching this result has been devised. Things have gone too far, and we are face to face with government operation in fact, if not in name.

In all discussions of government operation, therefore, we must admit that there is a certain class of utilities, now including railroads, which must be operated by the government, and as to this class we must devise methods of government operation which will preserve, so far as possible, the advantages of private operation and minimize the weaknesses of government control. The best way to do this is what Congress must now decide and is, perhaps, the most interesting and important problem before the country to-day. But it is a subject in itself, not within the scope of the present article, and I leave it with the comment that such methods must, and can, be found; for if not we are forced to the conclusion that, as this is a necessary function of the government, a democracy which cannot perform it is a failure, and the great war for democracy has been fought for a form of government not worth having.

### MONOPOLY DANGEROUS TO ESSENTIAL INDUSTRIES

But now if you are interested in any other public utility, or for that matter in any great industry dealing in a necessity of life, it behooves you to see where you stand. You are apparently on the brink of a chasm into which you are about to fall, for analysis of your position will lead you to the conclusion that when an industry or service essential to the nation's life has become a monopoly through the destruction of competition the government must control it, with government operation as the final result. It has been suggested in the case of the railroads that they be combined into fifteen or twenty powerful units operating between the great industrial centers, rather than into one great system, in order that comparison of operating results may be possible; and there are those who call this competition. But it is not the real article and is unlikely to produce the same result. It is comparison—a very different article; its value remains to be proved.

It is now obvious that the railroad business has developed beyond the possibility of private management. Government operation has come to stay, and extension of the principle to the street-railway business appears only a question of time. Other public utilities, like the electric light and power business, are subject to the same influences and are threatened with the same fate. I say threatened for the sword has not fallen.

### COMPETITION IN POWER BUSINESS

The electric power business, in particular, is in a far healthier condition than the railroad business, and the reason is not far to seek. Competition of a real sort (not mere comparison of operating results) is still alive; for while it is true that most electric companies are supposed to have a monopoly in their own territory, and have been put under local regulation for that reason, they still have to compete for their power business (which is the backbone of the industry) with their customers, though not with each other. It

is still true that a large power customer can make his power as cheaply as most companies, and if the company's price is not low and its service good, he will do it. The blighting hand of government regulation has hardly touched the power business. There competition between company and customer, strengthened by comparison of results between companies similarly placed, has kept the business healthy. So long as such real competition survives it will remain healthy, and no longer. Competition is as essential to health and growth in industry as exercise to the human body. It bears the same relation and stands in the same place.

### REGULATION OF COMPETITION VITAL

What we must discover, therefore, is not how to regulate public utilities, but how to stimulate, or produce, competition, and how to regulate that.

The nation yearns for competition—for the good old days when prices were made and service fixed by the laws of supply and demand and not by regulating commissions. Men want to go back to the condition which made the nation industrially great. But men can never go back—the hands of the clock go ever forward and what has been alive but is now dead cannot be resurrected. Fortunately, in this case we do not have to; we do not need to go back to industrial competition because we never had it. We had, not competition, but industrial war—not a series of contests or matches, but of gladiatorial shows in which the loser met not defeat but death. The unsuccessful competitor was killed and eaten by his adversary when the contest closed—a heartless and unthinking public looking on and applauding with glee. But the supply of gladiators is giving out. Only the boldest and fiercest spirits will compete on such terms, and the games tend to stop for lack of contestants. Probably this was a phase through which it was necessary to go, and doubtless it served its purpose; but it was not competitive in the sense that our great national game—baseball—and all our sports are competitive.

And here perhaps we may find an illuminating indication of the way out of our dilemma. Professional baseball is a commercial enterprise—highly successful and perfectly competitive. In this field we succeed in selecting, by a perfect process, the most skillful players from all the able-bodied men in the country. The great players in the major leagues, automatically culled from the whole nation, are undoubtedly the best possible selections.

### THE SPUR OF COMPETITION

But how long would this last if there were no "rules of the game" and no umpire to enforce them—if the winning team killed and ate its rivals and locked up the abandoned club house? Not so long, one may predict, as our so-called industrial competition has lasted. The comparison holds good in all our competitive sports. Competition goes on; keen, honest rivalry drives our boys and men to their maximum effort. Under a perfect process of selection, competition, instead of being stamped out, is promoted, and there is no tendency toward "trusts and combinations in restraint of trade." Quite the contrary—new teams are organized and rivalry becomes more widespread and intense. And the key to it all is found in a clear set of "rules of the game" with an umpire to enforce them. That is what we must have in all business. Every industry must be organized and controlled in that way, not alone the so-called utilities. For it is going to be very difficult to draw the line. Many industries deal with necessities of life and, as they grow great, tend toward monopoly requiring government control. Street-railway service is not more necessary than coal or bread, or steel or meat, nor is the electric light company more potentially a public utility than the coal company, the packer or the farmer.

### INDUSTRIAL WAR BREEDS MONOPOLY

Industrial war can end only in monopoly, because the winner kills his rival. But establish your rules and appoint your umpires and all this stops. Competition—real competition—begins for the first time, and our problem is not how to regulate utilities but how to regulate competition. Regulation of utilities as a substitute for competition has been tried and failed. But we have never really tried to regulate competition. Unregulated competition, or industrial war, we have tried and found that it produced intolerable evils. But the case is not hopeless. Already a beginning has been made. The Federal Trade Commission is a step—if a blind and halting one—in this direction, and all that is needed now is to work out and develop the idea. Perhaps we shall find that it is not capable of universal application. Competition may not be best in every line of human activity, but it is certainly good in many lines of public utility, and it can be had.

### GOVERNMENT OPERATION TO BE AVOIDED

The application of this to the electrical industry is obvious. Our thinking has been amateurish and our use of terms loose. We have talked about "public utilities" and "private business affected with a public interest," as if all the great basic industries were not potential public utilities, or a railroad were not in fact "a public business affected with a capitalistic interest." There are certain utilities which the government must control—highroad, domestic water supplies, the post office, the railroads and perhaps others. But government control means government operation, which should, where possible, be avoided. The electrical industry has not come to that yet, but we have been striving in the wrong direction—we have been working for monopoly under regulation when we should have been working for competion under regulation. It is not yet too late, but it soon will be if we do not alter our course and act with vigor and real purpose. We must stimulate competition and keep it alive, instead of trying to kill it. What we want is sporting competition in place of gladiatorial shows. Ways and means must be devised.

The foregoing is not inconsistent with the view held by many, that the electrical business is destined to become so essential to our national life as to be a necessary function of the government. Perhaps it is. But it is not yet, and until that time comes it is the business of the men who guide it to keep it healthy. Competition, and competition alone, can do that. And in the process of keeping this business alive we may well be pioneers and inventors, showing the way in which all business should be regulated. That would be an invention indeed; that is the true statecraft of industry, and is a business to which any man may set his hand with the conviction that if he fail no harm will result, and if he succeed he will be a true benefactor to mankind and his name will go resounding down the ages.

# Additional Comments on A. I. E. E. Changes

## Suggestions for Work of Engineering Congress by Past-president Stillwell—Comments on Papers and Publications by Dr. Louis Bell—Other Discussions on Changes Proposed by Development Committee

IN RESPONSE to the invitation extended by the ELECTRICAL WORLD to its readers to present for publication their views on the changes in the activities of the American Institute of Electrical Engineers as proposed by the development committee in its recent reports, letters have appeared in the Aug. 2 and Aug. 9 issues. In the Aug. 2 number the report of the development committee as presented at the Lake Placid meeting was given in full with extended comments by Dr. Charles P. Steinmetz and others. In the issue of Aug. 9 later changes in the report of the committee (printed in full in this issue, beginning page 374) were reviewed and thirteen comments from members of the Institute were presented, four of which dealt with features of the changes as proposed, while nine expressed inability to offer comment from lack of time or unfamiliarity with the recommendations of the committee.

### SYNOPSIS OF THIS WEEK'S DISCUSSION

In what follows additional comments are presented. That by Past-president Stillwell calls attention to the work of the French engineering congress and outlines questions that a national congress of engineers in this country might consider together with the ways in which the work might be taken up. He points out that at the meetings of the French engineering congress in Paris held last winter the papers displayed an aim at more practical results than usually is evident in the case of meetings of our own engineering societies.

Dr. Louis Bell points out that the scope of electrical engineering has been so widened and become so interlocked with other branches of engineering that the old A. I. E. E. organization is out of date. How to appropriately use the vast power of the Institute of to-day he outlines in suggestions on new work and comments on changes that have already been proposed and discussed through these columns. Dr. Bell indorses Dr. Steinmetz's call for a review of the art through the Institute *Proceedings* and *Transactions* and registers a like protest against popularization of papers. He gives five constructive suggestions aimed at improvement of the *Proceedings*.

Other interesting viewpoints are presented by Prof. D. D. Ewing and Prof. C. Francis Harding. The former outlines in a definite manner the functions of the A. I. E. E. which to him seem important from wide experience in teaching and in practical work. An equally definite viewpoint is expressed in regard to the service of the Institute *Proceedings*. He calls attention to the fact that there is no real need for popularizing engineering literature, while it is vitally important on the other hand that the standards of the Institute be held high in all its activities.

Professor Harding comments on the character of papers now published in the *Proceedings*, pointing out that many of these are of interest to but few of the members, while important papers of general interest presented before the sections and branches remain unpublished. He proposes a method to correct this and points out that the needs of the Institute branches should be recognized.

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## ORGANIZATION AND WORK OF ENGINEERING CONGRESS

### Need of Engineering Consideration in Economic Questions—Work Done by French Congress Cited as Indicative of Results Possible

*To the Editor of the* ELECTRICAL WORLD:

SIR: The development committee of the American Institute of Electrical Engineers has indorsed the suggestion that the engineers of America should arrange from time to time an engineering congress. It is greatly to be hoped that the Institute will take the matter up promptly and in coöperation with the other great national engineering societies carry it through to a successful conclusion. In no other way can the engineering profession contribute more effectively to sound economic progress. Members of the delegation of American engineers who attended the congress which assembled in Paris on Dec. 18 last at the invitation of the French Society of Civil Engineers came away with the conviction that an occasional congress organized on somewhat similar lines in the United States might be expected to secure results of far-reaching importance not only to the engineering profession but to the American public.

### DUTY OF ENGINEER AS A CITIZEN

It is probably safe to say that the great majority of American engineers realize that as a profession we have not hitherto made ourselves felt in influencing public opinion to that extent which our duty as citizens demands. For example, the views of the public and the policy of our government in respect of the utilization of water power have for many years followed the mistaken leadership of the self-exploiting politician rather than the informed, far-sighted and patriotic judgment of citizens qualified to develop a policy economically sound. Our so-called conservation congresses have frequently been dominated by men who really were conserving nothing except their own political ambitions. These men have not hesitated to mislead a numerous body of followers, many of whom have been actuated by the best of motives, but whose influence thus misled has been exerted in direct opposition to true conservation, to the benefit of nobody and to the detriment of the public interest.

No profession is more interested than ours in the adoption by the American people of sound economic policies in respect of the utilization of our natural resources. There is no profession which comprises among its members citizens more patriotic or in any way better qualified to formulate such policies, and yet as a profession we have been making little organized effort to inform the public or to influence governmental policy.

The French engineering congress of last winter held its meetings in Paris. At its general meetings a minister or ex-minister of the French government presided. It organized in five sections or committees—one on commercial ports, one on water power, one on navigable waterways, one on roads, and one on technical education. The papers presented were not many in number, but in general the object of practical results was kept more definitely in view than it usually is in the conventions of our American engineering societies. The conclusions of the French congresses are formulated in what might be called a platform set forth with brevity and in clear, non-technical language such as the minister of the government, the legislator, the journalist and even the average citizen can easily understand and apply.

It would seem that an engineering congress lasting from three to six days and comprising representatives of each of the great national engineering societies, limiting its program to the consideration of economic questions of importance to the profession and to the public, aiming to aid in the development of sound policy and practice, and stating the conclusions reached in the form of recommendations available to the constituted governmental authorities, might exert great influence and perform public service of inestimable value. The members of such a congress should be appointed by the boards of direction of the several engineering societies. The congress should usually be held in Washington. There is no apparent reason which would prevent the extending of invitations to members of the Cabinet to attend meetings of the congress and even, possibly, to preside at some of those meetings, as is done in France.

### QUESTIONS FOR A NATIONAL CONGRESS

There are a number of great economic questions calling for prompt solution, one or more of which might well be selected for the consideration of an engineering congress to be held, for example, next winter.

The conservation of our coal and of oil and gas is an economic problem of fundamental and urgent importance which the engineering profession might greatly assist in solving by unbiased consideration leading to the formulation of definite recommendations.

The great problem of industrial unrest is one to the solution of which the engineer is peculiarly qualified to contribute, working as he does with labor on one hand and capital on the other and possessed to a great extent, as he is, of the confidence of both.

The unvarnished facts in respect of inland waterways as a means of transportation should be ascertained and published by a congress of citizens qualified by ability and experience to pass upon the economic questions involved.

Highways, national and state, should be discussed by the best minds of the engineering profession, not only from the technical standpoint which considers methods of construction, maintenance, etc., but from the economic standpoint which considers the benefits direct and indirect which they bring to nation and state and weighs carefully their relative cost and advantages as compared with railway facilities and also with waterways.

These are critical days in world economics. The engineering profession in America is able to contribute effectively to the solution of some of the greatest problems which confront our people. A national engineering congress organized along the lines suggested would be of great value in clarifying confused minds and establishing facts vitally needed as the basis of national policy.

LEWIS B. STILLWELL.

New York.

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## VARIATIONS IN POLICY OF INSTITUTE GREATLY NEEDED

### Local and General Federation with Other Bodies Questionable—Decentralization of Work Desirable and Changes in Publication Suggested

*To the Editor of the* ELECTRICAL WORLD:

SIR: Every member of the American Institute of Electrical Engineers will read with keen interest of the proposed change in its activities. Changes had become inevitable, and perhaps it was well to present a revolutionary program to provoke free discussion. As a member of nearly thirty years' standing the writer is somewhat familiar with the growth and development of the Institute and has long felt the need of some variations in policy. The fundamental fact is that the scope of electrical engineering has been so widened and it has become so interlocked with other branches of engineering that the old organization is out of date. To-day the specialized societies hold the real interests of active engineers, and this fact must be recognized. One is reminded of Dr. Oliver Wendell Holmes' delightful little gentleman who would not arrogate to himself the title of entomologist but might aspire perhaps to be called a coleopterist. Nevertheless, every electrical engineer, like every scientific man, needs to keep in touch with general progress if for no better reason than to grip advances having a collateral bearing on his own specialty.

Hence the Institute has a vast power of usefulness despite the increasing number of societies devoted to particular fields of pure and applied science. At one time the Institute was inclined to discourage special organizations and lost prestige in so doing, for the change was necessary and unavoidable. Such modifications of policy as are now to be undertaken should be made with the definite purpose of making the Institute as indispensable in broadening the view of the specialist as it was during earlier days in bringing fresh knowledge to the profession then growing. Of the proposed innovations some are directly in this line of progress, others run counter to it.

### DECENTRALIZATION ESSENTIAL

The proposition for change in the organization seems wholly good. This country is ten times too large to deal with from a single point, particularly when that point is as far as possible from the center. Other organizations have found a federal system carried to its logical end advantageous, and the same principle applies to the Institute. If the vice-presidents do their proposed duty, the local sections can be kept closely knit in interests and coöperating. Further, the decentralization of committee work is equally necessary. Committees chosen from one region are to-day just as likely to do efficient work as if chosen from some other, while if taken quite at large they fail to get together often enough, and little is accomplished.

One cannot speak quite so enthusiastically of the scheme of local and general federation with other engineering bodies that are "worthy." It sounds a little too much like benevolent assimilation. How would the

Institute look upon a similar proposition to be carried out under the auspices of the A. S. M. E.? There has already been very friendly affiliation in the way of joint meetings of societies and sections, and there is likely to be more. It would seem better to leave the matter right there, for local treatment, than to start on a course which is bound to awaken doubts on the part of some as to its altruism.

### PAPERS AND PUBLICATIONS

As regards papers and publications, the most serious questions arise. Experience has shown that the average quality of papers read is high, as a look through the published *Transactions* readily proves. Nor is there any reason to expect deterioration in those read before the sections. If they are worth listening to and discussing, they are worth publishing. They should, however, be shorter than the prevailing practice in order to render publication less burdensome. Very few papers could not be boiled down with positive advantage. This, however, is a very different thing from the publication by syllabus proposed, which is likely to estop printing in full elsewhere, so that the profession would lose valuable material. Nor is there occasion for popularization of papers, for there is no indication that our younger members are in need of food for babes. They are in fact quite as keen in theoretical matters as many of their seniors; moreover, engineering education would have to be branded a failure.

### REVIEW OF THE ART

The writer heartily indorses Dr. Steinmetz's call for reviews of the art, which are invaluable both to the specialist and to the beginner in furnishing a broad view of what has been accomplished. Even more important is it to furnish abstracts of papers published elsewhere, as comprehensively as possible. It is doubtful whether the author could always be counted on for the abstract, but he could have a chance at it whenever possible. Abstracts are generally useful in pointing out the scope of a paper and its important conclusions, but they cannot take the place of the thing itself, and the proposition to publish most Institute papers by abstract only is a shabby and mischievous economy. Along the same line of thought, discussions, while limited in length, ought to be published in full, since they often prove exceedingly valuable additions to the paper itself —especially oral discussions, which often let the cat out of the bag in which he has been decorously hidden. The trouble with many Institute discussions is that they are too carefully prearranged and more or less "denatured."

To pass to the constructive phase of the matter, the writer's idea of Institute publications would be somewhat as follows: (1) A *Bulletin* published monthly and containing announcements, routine matter and notices of meetings held, together with such briefs as are now printed at the head of the advance copies of papers, each bearing a serial number. (2) A supply of advance copies on a larger scale than at present to allow mailing to members requesting copies by number, after the receipt of the *Bulletin* noting them. (3) The *Transactions*, issued quarterly in two parts separately paged and bound in paper: (a) Papers, discussions and technical committee reports in full; (b) abstracts of the general literature. This would abolish the present monthly publication, put copies of papers promptly into the hands of those really interested, and furnish the valuable and permanent *Transactions* without inconvenient delay.

### BANEFUL EFFECT OF ADVERTISING

As to the proposed change of form and concurrent advertising campaign, it is not easy to speak without indignation. The Institute has found it hard enough to stear clear of open or covert commercialism without putting a staff of publicity bounders at the helm with profit their only beacon. A new electrical advertising medium is not needed, and if it were, it is not the place of a learned society to jeopardize its standing by undertaking the job. The Institute has earned its distinguished place by earnest efforts to raise the standard of the profession, to be in all things judicial and free of entangling affiliations, and to bring together even commercial foes in the fraternity of science. If it now openly goes out after the depreciated dollar, it must follow trade methods, and proceeding however carefully would at best only add another to the list of decent and successful trade journals. LOUIS BELL.

Boston, Mass.

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## ACTIVITIES OF THE SECTIONS IN THE INSTITUTE WORK

### Suggestion that Institute Should Be Broadened to Be More Representative of Nemberships and to Recognize Needs of Branches

*To the Editor of the* ELECTRICAL WORLD:

SIR: The writer is convinced that the very timely policy of the development committee of the American Institute of Electrical Engineers, which was actively discussed by a relatively small portion of the membership at the recent Lake Placid convention, is of sufficient importance to be given general publicity.

It has been felt for several years, especially by the younger members, that the activities of the Institute should be broadened and made more representative of the membership at large. The proposed reorganization, involving the election of vice-presidents from geographical sections, the formation of a section at New York, and the policy of holding meetings in different portions of the country, will assist materially in the democratization of the Institute.

There remains, however, the condition that the *Proceedings* contain many papers of interest to but few of the members, while important papers of general interest presented before sections and branches remain unpublished. This unsatisfactory procedure is carried out at great expense, and we are told that the desired change cannot be made without materially increasing the income, either from dues or from a more extensive advertising policy.

The suggestion was made by the writer, through the auspices of the Indianapolis-Lafayette Section, that a relatively small number of advanced copies of the technical papers be printed in pamphlet form, the number varying with the estimated demand for the paper. These papers should be printed in full in the *Transactions*, but the *Proceedings* should contain only a comprehensive abstract of papers of merit of this description presented before all sections and branches during the preceding month. A blank form might well be inserted in each copy of the *Proceedings* to enable members to in-

dicate which of the papers are desired in complete form. It is believed that by this plan the printing expense could be reduced sufficiently to permit more papers to be printed and the economic, employment and question-box features of the monthly *Proceedings* added to or expounded for the benefit of the majority of the distant members.

As chairman of the Institute committee on branches, the writer was surprised to find that the new development plans take no cognizance of the needs of the branches, although the latter have been repeatedly presented to the directors and discussed at nearly every recent convention. It should be recognized that the branches are the principal stepping stones to Institute membership and responsibilities. Impressions of Institute advantages and policies are gained by our younger members to a very large extent through contact with the branches. It is hoped that the action proposed to the development committee at the Lake Placid convention will result in some needed improvements in the branches as well.

The new development plan, with slight modifications indicated above, is a step in the right direction and should, in the opinion of the writer, be put into effect in the near future.

C. FRANCIS HARDING,
Head of School of Electrical Engineering, Purdue University, Lafayette, Ind.

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## FUNCTIONS OF A. I. E. E. LIE IN ELECTRICAL SCIENCE AND ART

### Important Work of the Institute—Service of Its "Proceedings"—Character of Material That Should Be Published

*To the Editor of the* ELECTRICAL WORLD:

SIR: I have watched with keen interest the work of the American Institute of Electrical Engineers' development committee, and as I was unable to attend the Lake Placid meeting and hear the discussion there presented on the committee's report, I have greatly enjoyed the comments thereon published in recent issues of the ELECTRICAL WORLD.

#### IMPORTANT WORK OF INSTITUTE

As I see it, the most important work that the Institute can do is to afford its members means, through its publications and meetings, whereby they may keep in touch with new developments in the sciences and arts pertaining to their profession; to provide for its members, in a convenient form for reference, a permanent record of these developments, and to develop and maintain high technical and professional standards. To me matters of social, economic, political and industrial welfare and the education of engineering students, while in themselves very important, are secondary matters as far as the American Institute of Electrical Engineers is concerned. The Institute should not attempt to spend the bulk of its energy and means on problems with which some other body or organization is better equipped to cope.

The Institute is eminently well prepared to do the things that I have suggested as constituting its most important work, and I heartily indorse, therefore, Dr. Steinmetz's statement that "the Institute publications are the last activity in which retrenchment should be considered, and curtailment in this direction would be suicidal." I also indorse Lamar Lyndon's objection to returning portions of the *Proceedings* for permanent binding. Clippings or portions of the *Proceedings* form a part of the working library of many electrical engineers, and their daily use in office and laboratory renders their return to the Institute for binding in permanent form out of the question.

#### POPULARIZING THE "PROCEEDINGS"

There is no real need as I see it for popularizing the *Proceedings*. The technical press of America is most energetic and stands on a par with any in the world. If a real need for any more "popular" technical papers existed, we would have them. Neither engineers nor would-be engineers turn to the technical papers for amusement or for the stories of Jules Verne and some of the writers who have tried to follow the footsteps of that ingenious Frenchman. Nor do I believe they care for emasculated technical literature in their working libraries. Predigested literature is of little value where one is grubbing for the roots of things—the reasons why. The Marathon runner does not take his training by strolling leisurely along flower-bordered paths in a pleasure park. He hardens his muscles and develops his wind by the grueling mill of the long hard run over the highways and byways, overcoming difficulties as they appear. The path to successful attainment is no easier for the brain worker than for the muscle worker.

#### ADVERTISING IN "PROCEEDINGS"

Increasing the revenues by obtaining more advertising seems to me a most undesirable method of securing additional funds to carry on the work of the Institute. Existing technical papers completely take care of this field, and in entering it the Institute would simply enter a commercial field in competition with other organizations that are now serving that field in an admirable manner. It would not be performing a necessary service in any sense of the word, and the prestige and independence of the Institute would suffer. Above all things, the Institute should keep itself clear of the suspicion that its councils are dominated or even in any way influenced by commercial interests, and this it will not be able to do if it attempts to do commercial advertising on any considerable scale in its official organ.

#### PRESENT PUBLICATIONS SATISFACTORY

As I see it, the present publications of the Institute are quite satisfactory. If I have any criticism at all, it is that they do not contain enough papers dealing with the developments in the theory and science of electrical engineering. In this matter at least I am not in accord with the ideas expressed by H. A. Hornor in the ELECTRICAL WORLD for Aug. 9, who, if I read his thought aright, feels that the stress should be placed on the art rather than the science side of the work of the profession. We need both sides, and the exclusion of either must necessarily result in lopsided development.

With practically all of the other recommendations of the committee I am in hearty accord. I am not certain, however, that the suggestion that technical schools establish six-year courses was based on a sufficiently thorough and careful study of the subject.

D. D. EWING,
Professor of Electrical Railway Engineering, Purdue University, Lafayette, Ind.

# STATION & OPERATING PRACTICE

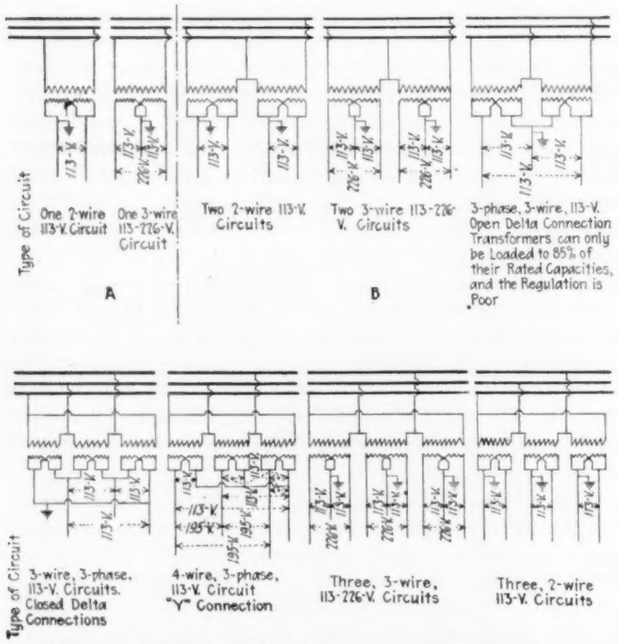
## A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

### LIGHTING SYSTEM FED FROM THE POWER LINES

**Combined Power and Lighting Allows Lower Rate for Consumer and Decreases Initial Investment and Necessary Maintenance**

By combining lighting and power loads on one three-phase service line, consisting of three wires and one three-phase meter, the Edison Electric Illuminating Company of Boston has been able to furnish energy for lighting to industrial plants at the power rate and to decrease the initial investment. This system requires only one three-phase transformer and thus simplifies the installation of transforming equipment and eliminates the use of a single-phase unit for lighting loads. In addition, it is unnecessary to have a fourth or neutral wire on the 2300-4000 volt primary circuit, which is required only for the connection of single-phase transformers.

Although the three-phase transformer has to be large enough to take care of the lighting load, its added cost


Type of Circuit
One 2-wire 113-V. Circuit
One 3-wire 113-226-V. Circuit
A
Two 2-wire 113-V. Circuits
Two 3-wire 113-226-V. Circuits
B
3-phase, 3-wire, 113-V. Open Delta Connection Transformers can only be Loaded to 85% of their Rated Capacities, and the Regulation is Poor
Type of Circuit
3-wire, 3-phase, 113-V. Circuits. Closed Delta Connections
4-wire, 3-phase, 113-V. Circuit "Y" Connection
Three, 3-wire, 113-226-V. Circuits
Three, 2-wire 113-V. Circuits

METHOD OF COMBINING POWER AND LIGHTING LOADS

*A* shows one transformer in use when total lighting demand is not greater than 5 per cent of total service demanded. *B* shows two transformers in use when total lighting demand is not greater than 10 per cent of total service load. *C* shows three transformers in use when total lighting demand is greater than 10 per cent of total service demand.

is a small percentage of the cost of a single-phase transformer. On account of the lighting being connected to the three-phase service wires, some provision has to be made for keeping the load balanced on the three different phases. This is true, however, only when the lighting load is a considerable percentage of the power load. To supply the lighting from the power mains it is necessary to install transformers to step the voltage from 230, 440 or 550 volts, as the case may be, to the lamp voltage, 113 volts. Where the total lighting demand is not more than 5 per cent of the total service demand, one transformer may be used, as shown in *A* in the figure, and where not more than 10 per cent, two may be used, as indicated in *B*. Where a greater load than 10 per cent of the total is connected three transformers are necessary in order to keep the load balanced. When three transformers are used it is necessary to have the load balanced on all three within 5 per cent, as it is considered that 5 per cent unbalancing is all that is permissible.

Where three transformers are used the distribution could be made in any one of the four ways shown in C—three-wire, three-phase; four-wire, three-phase; three independent two-wire circuits, or three independent three-wire circuits. If three transformers are used with independent two-wire or three-wire circuits, the lighting transformers may be installed in different parts of the plant, thereby saving the cost of carrying the wires from a central location to the places where the lighting is needed.

The only objection to feeding the lighting units from power lines is that the lights are subject to flickering at times, due to the variations in motor loads, but this tendency has not proved troublesome as yet. The power factor of the line is also materially increased in some cases on account of the non-inductive loads of the lamps.

### MACHINE LIFE SHORTENED BY HEAVY OVERLOADING

**Generators and Motors Which Should Last Twenty-five Years Break Down at End of Eight Years from Continuous Overloading**

Any really first-class motor or generator will last twenty-five years if treated properly and also serve as a good economical tool. In fact, a motor purchased second-hand and used to drive economizer scrapers has been known to last twelve and one-half years with a replacement of only two field coils. This good result was simply due to the fact that the motor was rated about 10 per cent above its load rather than 10 per cent below, so that even the hot atmosphere found near the economizer scraper gear did not ruin the insulation quickly. On the other hand, when a generator of first-class make and 800 kw. capacity is burned out in eight years and the insulation is baked to a crisp on the few coils which are not damaged, it is seen that the persistent overworking of such plants is not economical. Subsequent inquiry about this generator proved that it had always been the rule to work this set from 830 kw. to near the 900-kw. mark.

Another instance which shows that overloading is not

good judgment is the case of some induction motors carrying a very heavy load on the line shaft they drive, and often loaded very heavily owing to overheating of the machine tools. These motors are continually causing trouble, and because there is no visible exterior evidence of difficulty, more load was added to them with resultant complete failure. An electrical machine is controlled very largely by its heating limit, and if the machine does not have a large factor of safety, the heat developed in the windings on overload cannot get away as fast as it is generated, so that the insulation is simply baked until it loses its nature, crumbles, and sooner or later falls away and leaves a path to earth. Then follow a short, a big flash, and three-quarters of the armature or stator conductors is gone.

One firm spent over $75 each for the maintenance of three 15-hp. induction motors in the course of the last few years. This was not economical, and such experiences give non-technical mill and factory owners the idea that electricity is a source of constant trouble and petty annoyance.

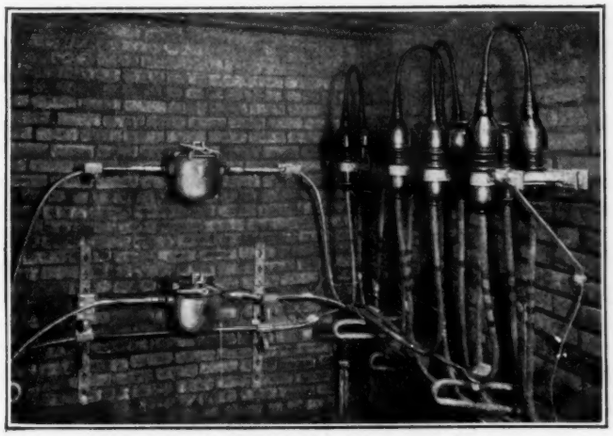
MARK MEREDITH.

Liverpool, England.

## PREVENTING EXPLOSIONS IN HIGH-TENSION MANHOLES

### Subway Oil Fuse Boxes Held on Wall of Manhole Are Not Likely to Cause Fires—Good Arrangement of Cables Described

Manholes often contain leakages from illuminating gas mains or other explosive gas which are likely to be ignited if any heated matter is thrown into them, and care must be taken to prevent this from happening by the failure of cables or fuse devices. This has been effectively accomplished by the Commonwealth Edison Company of Chicago in the manner shown in the half-tone reproduced. On the wall are mounted Schweitzer



FUSE CUT-OUT BOXES AND POTHEADS WELL ARRANGED IN MANHOLE

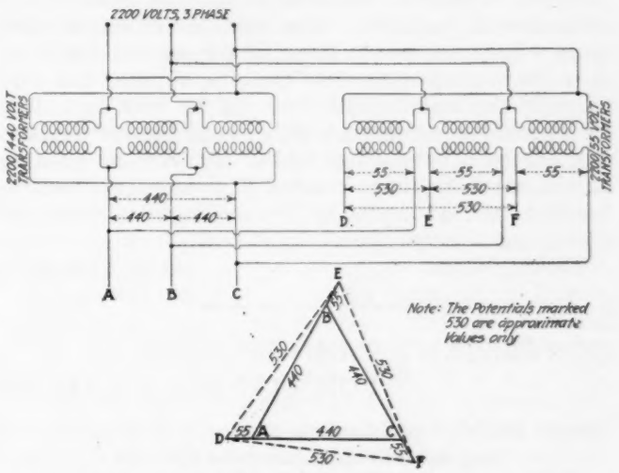
& Conrad subway fuse boxes so arranged that the covers cannot be thrown open on account of fracture of the cables. There is a renewable vent in the cut-out, slightly above the service connection, which will operate only in case of some abnormal condition other than overload. The cover of the cut-out is tightened simply by turning the wrench, and no bolts or nuts are required. Two refractory blocks under compression hold the fuse link between them, and a shield immediately below the handles of the plug almost closes the top of the oil tank.

Adjustable racks hold the cable on either side of the fuse box and direct the cables to the potheads. The potheads are held on the manhole wall by means of iron braces and bolts.

## BOOSTER TRANSFORMERS SAVE INSTALLATION COST

### Nearby Transformers with 440-Volt Secondary Used Intermittently Are Utilized for 550-Volt Service Aided by Small Transformers

Having to serve a 50-hp., 550-volt load from a 2200-volt line, the Public Service Corporation of Quebec obviated the expense of purchasing special transformers




VALUES MUST BE ADDED VECTORALLY TO OBTAIN ACTUAL BOOSTED VOLTAGE

by the addition of booster transformers to a 440-volt service. The load on the three service transformers was intermittent and easily provided the additional capacity for the installation. It obviated purchasing two 25-kw., 2200/550-volt transformers as only three small 2200/55-volt transformers were needed.

These were connected as shown in the diagram so that their voltage was added to the 440 volts furnished by the main transformers. Thus between *D* and *E*, *E* and *F*, *F* and *D*, there will be a potential of 55 plus 440 plus 55. To obtain the actual voltage these values will have to be added vectorially, but the difference between this and a numerical addition will in all probability be slight. All six transformers are mounted on the same stand.

Quebec, Canada. WALTER BUCHANAN.

## HEATING SWITCH HOUSE WITH TURBINE-ROOM AIR

### Temperature Further Raised by Passing Air Through Steam Coil Heaters—Switchboard Room Separately Ventilated in Summer

Heating and ventilating of power plants is usually not considered important because of the intense heat generated in the boiler room. Although the boiler room is comfortable in winter, other sections of the plant may be decidedly uncomfortable. An even distribution of heat is obtained in the plant of the United Electric Light Company of Springfield, Mass., by using some of the heated air in the turbine room for heating the switch house. In winter air is drawn from be-

neath the roof of the turbine room down into the basement of the switch house, where a blower discharges it up through Vento steam-coil heaters which utilize either high-pressure or exhaust steam. Another system of ducts collects the air and discharges it through ceiling registers into the switchboard room. From this room it finds its way out to the atmosphere through the skylight ventilators. Direct low-pressure radiation is supplied where necessary at certain north-wall windows.

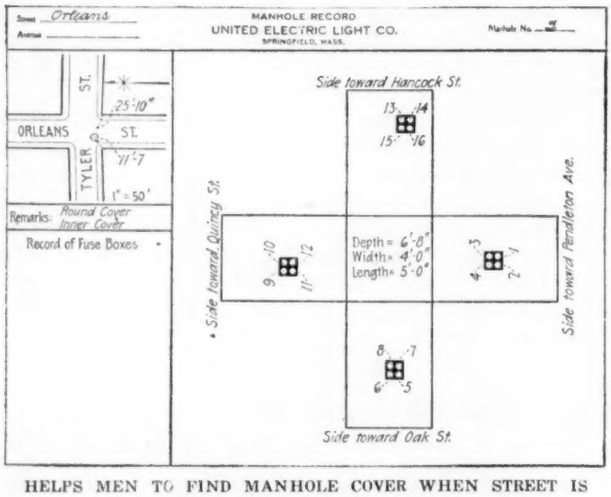
In summer air is drawn from the switch-house roof through a conical dust separator in the basement which is provided with a small water spray. The air is then by-passed around the Vento heater and distributed to rooms as before. The Vento heater may be used, however, if desired, in times of extreme humidity, to minimize condensation. The exhaust system operates as in winter weather to draw all air out and discharge it to the atmosphere except that the air does not pass through the switchboard room on its way out. The switchboard room is separately ventilated for summer weather by a special fan taking air from an opening in the north wall and passing it through the switchboard room by means of the ceiling registers and thence out through the skylight ventilators.

Boston, Mass. C. A. CORNEY.

## CONVENIENT CARD RECORD FOR MANHOLE CABLES

### Shows Position of Manhole Cover and Exact Cable Layout—Ducts Listed on Reverse Side of Card

To show the number and location of cables passing into or through manholes, the United Electric Company, Springfield, Mass., uses a handy card record, reproduced




HELPS MEN TO FIND MANHOLE COVER WHEN STREET IS COVERED WITH SNOW OR LEAVES

herewith. The record card, 9 in. by 12 in. (18.5 cm. by 30 cm.) in size, shows, on a map in one corner drawn to the scale of 50 ft. per inch, the geographical location of the manhole center by intersecting radii from adjacent street corners. This enables the cover to be quickly located when the ground is blanketed with snow, ice or leaves. Provision is also made for showing the exact cable layout on each side of the manhole by horizontal projection of the walls, as illustrated.

On the reverse side af the card the ducts are listed, with the cable numbers and classes of service involved. This record is of great value in the quick identification of cables in reconstruction or repair work and enables telephone inquiries regarding the cable layouts of manholes to be answered immediately.

## TOTAL RESISTANCE OF CONNECTIONS TO GROUND*

### What Parts Must Be Calculated to Determine Whether or Not the Ground Will Adequately Protect a System

If ground connections are poorly made or inadequate for the purpose for which they are intended, quite a hazard will be presented to both life and property. Care must be taken to determine accurately the exact characteristics and resistance of such connections in order to have complete protection. The actual or total resistance of the connection consists of three parts:

(1) A part contributed by the ground wire or other conductor which serves to make an electrical connection between the buried electrode and the electric circuit or metallic body which the ground connection is designed to serve; (2) a part contributed by the buried electrode itself, and (3) a part contributed by the soil.

The importance of the first is not great unless an exceedingly long ground wire is used or connection is made to a long service pipe in making water-pipe grounds.

The resistance of the buried electrode enters because of the fact that the current flows into the electrode at a point—that is, where the ground conductor is attached—and to reach the surface it must pass through the metal. Each element of current therefore traverses a path of greater or less length depending upon the distance between the point where the ground wire conductor is attached and the point where the particular element of current passes into the soil. The part of the total resistance contributed by the buried metal is the combined resistance of all these parts in parallel. The part of the total resistance contributed by the metal can be neglected and confined to that due to the soil surrounding it. However, for electrodes of great length and comparatively small cross-section this may not be the case. Where water pipes are used, for instance, a large part of the element of current must traverse the pipe over considerable distances before passing into the ground, and since these paths are of great length in comparison with their cross-section, they may contribute very appreciably to the total resistance especially if the pipe contains high-resistance joints.

The part of the total resistance contributed by the soil is the most important in nearly all cases as the resistance, especially if the pipe contains high-resistance of all the paths of the current elements in parallel, and since the resistivity of soil is high, this resistance will be high unless the electrode is very large and the comparative number of paths therefore very great. To obtain the resistance to flow of current away from a single electrode, current may be made to flow from it to an electrode of such great extent that its resistance could be considered negligible.

*Excerpt from Technologic Paper of the Bureau of Standards No. 108—"Ground Connections for Electrical Systems," by O. S. Peters.

# INDUSTRIAL APPLICATIONS

## The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

### MOTOR CARD RECORD HELPS IN MAINTENANCE WORK

**When Motors and Control Equipment Need Repairing New Parts Can Easily Be Ordered from the Indications on the Record Card**

A complete card index of all the motors is kept in a large printing concern in order to facilitate maintenance and allow the quick ordering of necessary parts. When the machine operator reports trouble with the

Dept. Pressroom Driving: Press #5
Motor, No. 226769 Wound shunt Type SK Class
Form Amps. Volts 230 R.P.M. 1150/1100 H.P. 3-3/4
Westinghouse #20
Brushes, No. 4 W. 3/4" T. 7/8" L. 1 7/8"
with pig tail
Armature, No. Size Wire Insulation Turns
wound span pitch coils per slot
Fields, No. size wire;—shunt sicres
Pulley, bore 1 7/8" diam. 4" length 6" key
Bearings, no;—front 15157 rear 15159 type white metal
Control Cutler-Hammer-Bul 6423 H.3/4 H.14K 230

CARD INDEXED ACCORDING TO DEPARTMENTS INDICATES DETAILS OF MOTOR AND CONTROL APPARATUS

driving motor a quick glance at the card tells the electrician the size and type, speed, type of brushes and many other necessary details about the motor. If bearings are worn or if the motor controller is damaged, the necessary parts can be ordered without delay. The cards are arranged in the index by departments and are in rotation according to the number of the press so that it is an easy matter to locate them.

In addition, the cards are used for determining the power charge for the several departments. An hourly charge is made on each press. There are about twenty-five in all, and because it would not be economical to meter each machine the power charge is estimated. A wattmeter measures the entire energy consumption, and the charge is apportioned among the machines in accordance with their connected loads.

New York. W. A. HEFNER.

### THREE-PHASE MOTORS USED ON SINGLE-PHASE LINES

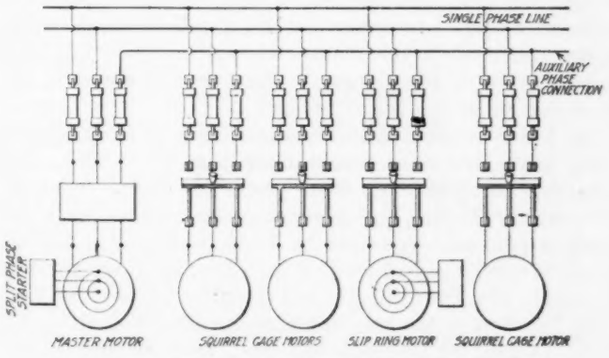
**Third Phase of Each Motor Connected to Common Bus—One Motor Running Light Supplies Auxiliary Current to Motors Under Load**

It often happens that utility customers have a supply of three-phase motors when only single-phase service is available, or that a customer is asked to purchase single-phase motors until the load becomes large enough to justify a three-phase line extension. This difficulty can be overcome by a system patented by Professor Arno in which the inherent characteristics of three-phase motors are developed from a single-phase source of supply.

The system, which is used extensively in Australia, calls for the use of a three-phase master motor in addition to the three-phase power motors. The master motor is a standard machine of either the squirrel-cage or wound-rotor type, and the larger the better. The lower size limit of this motor is in practice about 10 to 15 per cent of the total load connected to the system and is at least double the size of the next largest motor. All motors, including the master motor, are connected to the single-phase supply mains, and the third phases, which are not connected to the source of supply, are connected together.

The master motor is started up under no load with special starters equipped with an auxiliary winding similar to that used for the starting of split-phase induction motors. The master motor should as a general rule run unloaded as a phase giver. It is permissible, however, to load the master motor up to about 25 per cent of its normal rating in special cases, but even when the master motor is running mechanically loaded, it may be electrically overloaded. Any of the power motors becomes a master motor immediately its load is thrown off, and if the master motor cannot properly perform its function, a small unloaded power motor may become overloaded in helping out the master motor.

Through the voltage induced in the master motor's




METHOD OF OPERATING THREE-PHASE MOTORS FROM SINGLE-PHASE LINE

The four motors to the right are power motors, and the one to the left is a master motor which has its third phase connected to the third phase of all the other motors. The master motor is started up as a split-phase induction motor and runs light. Its function is to supply auxiliary current to the third phase of the other motors, and by this means the three-phase power motors are given practically the same characteristiscs as if they were operated from a three-phase line.

third phase, which is not connected to the supply mains, such motors at full speed are able to supply auxiliary current to the loaded motors during starting and overload periods. As long as the master motor is running the overload capacity of the loaded motors is

raised, as compared with purely single-phase induction motors, and the three-phase motors are able to start up from the single-phase line with practically the same starting torque as they would have when connected to a polyphase line. Should all the motors including the master motor be loaded to the same extent in proportion to their rated capacity, no current would flow in the third-phase connections. After the master motor has been started up, the working motors can be started one after another as regular standard three-phase motors. The gain in efficiency by operating the individual motors as three-phase units is practically offset by the losses in the master motor, so that the overload efficiency of the whole installation is about the same as that of a straight single-phase system. The normal output of the power motors when operating in this manner is about 75 to 80 per cent of their standard three-phase rating.

## ELIMINATING MOTOR TROUBLE DUE TO STATIC ELECTRICITY

### Grids Placed Near Driving Belt Eliminate Exterior Static, but a Corona Leaf Is Necessary in Motor Winding to Prevent Breakdown

In factories making bronze and aluminum powder the air contains considerable suspended metal dust, which becomes very dry, especially in some seasons, and produces a large amount of static electricity. This frequently happens near large leather belts, and in order to prevent explosions it is necessary to take every precaution to obviate the production of static. This became a serious problem in a Canadian plant where several 50 hp. three-phase, 60-cycle squirrel-cage motors driving line shafting through belting were housed in separate rooms kept as dust-tight as possible. Shortly after putting the motor to work it was noticed that a large amount of static was being produced, and at times it was difficult to approach within 3 ft. (90 cm.) of the belt. After two weeks of continuous running one of the motors broke down, apparently grounded; but just prior to the accident small explosions occurred in the motor, emanating from the bottom portion of the air gap. These explosions were attributed to static from the belt.

In order to prevent this static a grounded discharger was made and was placed near the belt. This discharger consisted of four pieces of ¼-in. by 1-in. (3-mm. by 25-mm.) iron strips arranged vertically to form a grid and separated by 1½-in. (3.8-cm.) pieces of ¾-in. (7-mm.) iron piping, ⅜-in. (7-mm.) bolts passing through the four pieces and holding them together. The top bolt holds two angle plates, made of ¼-in. by 1-in. (6-mm. by 25-mm.) flat iron, with which the top part of the device was secured to the wall. The two outside vertical pieces were made long enough to reach the floors, to which they were secured by screws, and the two inside pieces were made long enough to span the belt as near the motor pulley as possible.

The principal feature of this device is that by bridging both sides of the belt it is rendered impossible for static to collect, and the device has a distinct advantage over many makeshifts, such as a piece of wire or an arc-lamp carbon holder placed on either the top or the bottom side of the belt, because these protect only one side of the belt and in places like the one in question, where static is acute, do not afford sufficient protection. This discharger completely protects the belt.

After the installation of this device motors which had been continually breaking down ran for a period of six months without trouble; then another breakdown occurred. The symptoms were a slight pitting due to minute sparks emerging from the ventilating ducts just prior to complete failure. The relay had also been tripped at irregular intervals. A removal and test of the motor showed a puncture through three of the coils which caused them to become grounded.

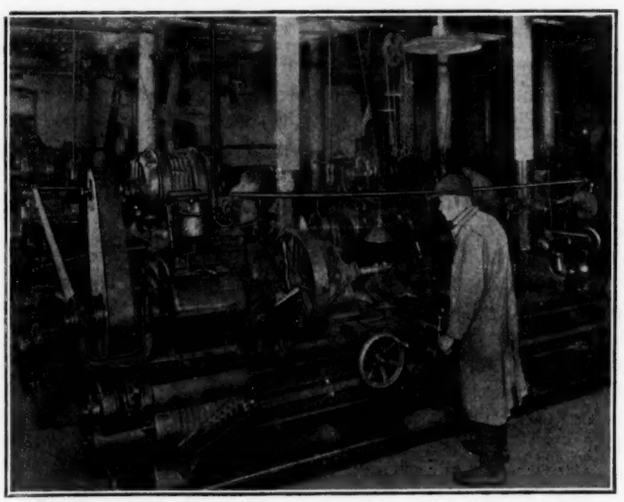
On rewinding the stator a corona leaf consisting of tinfoil was inserted between the insulation and the tape of each coil. The foil emerges from the end of the slot and is connected to a wire ring which is fastened to the frame immediately above the slots. The use of the corona leaf effectively prevents static being produced in the motor itself. Inclosed motors were not used, on account of the expense of replacement and the lack of assurance that they would be immune from the same trouble unless fitted with the corona leaf.

Valleyfield, Quebec. L. E. WOOD.

## LATHE MOTOR CONTROLLED BY A HORIZONTAL BAR

### Starting and Stopping Arrangement Is Similar to Method Used for Throwing Machine on Line Shafting—Operated from Any Position

Instead of having a one-point or two-point control for connecting the driving motor to the lathe shaft, an industrial plant in New England has installed a clutch mechanism on some of its direct-driven lathes which allows the lathe to be started from any position along the machine. The motor and the starting switch are mounted on the lathe above the variable-speed gear box, the former driving the lathe by means of an inclosed leather belt kept tight by means of an idler. A clutch between the belt pulley and the end of the lathe shaft controls the rotation of the lathe and is actuated by a horizontal bar pivoted and lever arm mechanism. The bar extends the whole length of the machine and starts or stops the lathe spindle as it is moved back and forth. As this movement is similar to that of moving a line shafting clutch, the operator experiences no difficulty with this control.



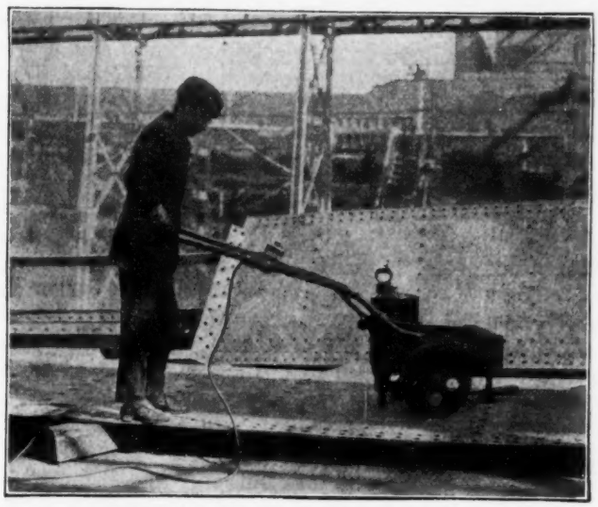
MOVING THE BAR BACK AND FORTH STARTS AND STOPS THE LATHE SPINDLE

## PORTABLE ELECTRIC DRILL IN COUNTERSINKING PLATES

### With Truck Mounting It Can Be Moved Over Sheet Iron for Countersinking Holes at Speed of 7 Seconds for One 7-8-In. Hole

A portable electric drilling machine has recently been advantageously employed in countersinking ship plates at a number of fabricating shops engaged in work for the Emergency Fleet Corporation. Previously a wall radial drill had been used for that purpose, but the portable electric drilling machine attached to a buggy has resulted in more speed and smaller labor cost.

A Van Dorn electric drilling machine is fastened into the truck by two studs, these studs being screwed to



CAN BE MOVED OVER IRON SHEETING SO THAT DRILL IS DIRECTLY OVER HOLE TO BE COUNTERSUNK

trunnion bosses on the housing and fastened to the handles of the buggy. The buggy is counterweighted in front, leverage being provided by pressure applied to the handles. When the plates are laid out on the shop floor it requires only an instant to move the machine from one hole to another. It is claimed that the buggy enables this machine to countersink a $\frac{7}{8}$-in. (22-mm.) hole in seven seconds.

## ALTERNATING AND DIRECT CURRENT USED IN PAPER MILL

### Variable-Speed End of Paper Machine Driven by Direct-Current and Constant-Speed End by Alternating Current

For driving a 165-in. (420-cm.) Fourdrinier machine producing approximately 50 tons of paper per day, the Brown Company, which owns a paper mill in New Hampshire, has installed complete electrical equipment. The variable-speed end of the paper machine is driven by a 400-hp., 550-volt, 36 to 600 r.p.m. adjustable-speed direct-current motor, while the constant-speed end is driven by an alternating-current constant-speed motor taking power from the main power-supply system. Power is furnished to the 400-hp. motor by a 300-kw., 600-volt direct-current generator having a direct-connected exciter geared to a non-condensing steam turbine. This outfit is designed to run on 100 lb. (7 kg. per sq. cm.) steam pressure, and the turbine exhausts under 5 lb. to 10 lb. (3.5 gm. and 7 gm. per sq. cm.) back pressure into the dryers of the paper machine. The seven-to-one speed range on the 400-hp. motor is obtained by combination motor and generator field control through the use of a control panel with a motor-operated rheostat.

Besides the Westinghouse electric drive several advantages are obtained by the use of a steam turbine. The steam is supplied to the dryers free from oil, which is neecssary in order to obtain efficient operation. Moreover, the turbine is placed more conveniently to the live-steam supply, and the motor is more convenient for the drive of the variable-speed end of the paper machine.

## EFFECT OF WALL COLORS ON LIGHTING REQUIREMENTS

### Chart Given Which Indicates Percentage of Light Reflected by Surfaces of Different Colors

The amount of illumination required in a room for a given intensity depends largely upon the amount of light absorbed by the walls and other surfaces. Dark surfaces absorb light and make for gloom and glare. Light surfaces throw a good proportion of the light back into a room and make for effective illumination. If the source of light is not changed, the effective illumination will vary with the reflection factors of the surfaces in the room. If, on the other hand, it is desired to maintain a fixed intensity of illumination in a room, then the amount of light to be supplied will vary inversely as the reflection factors, which are as follows:*

| | Per Cent. |
|---|---|
| Flat tone, white | 79 |
| Enameloid, white | 80 |
| Flat tone, pearl gray | 63 |
| Enameloid, French gray | 39 |
| Enameloid, gray | 28 |
| Flat tone, silvery gray and Caen stone, equal parts | 56 |
| Flat stone, silver gray | 52 |
| Flat tone, pale azure and buff stone, equal parts | 38 |
| Flat tone, lichen gray | 70 |
| Flat tone, ivory white | 76 |
| Flat tone, ivory | 72 |
| Enameloid, ivory | 64 |
| Enameloid, primrose | 67 |
| Flat tone, caen stone | 72 |
| Flat tone, ivory tan | 58 |
| Flat tone, cream | 71 |
| Flat tone, buff stone | 46 |
| Flat tone, buff | 59 |
| Enameloid, flesh | 57 |
| Flat tone, tan | 37 |
| Enameloid, tan | 27 |
| Flat tone, cocoanut brown | 22 |
| Flat tone, bright sage and ivory tan, equal parts | 47 |
| Enameloid, satin green | 56 |
| Flat tone, bright sage | 43 |
| Flat tone, forest green | 21 |
| Enameloid, olive green | 14 |
| Enameloid, grass green | 10 |
| Flat tone, pale azure and white, equal parts | 45 |
| Flat tone, pale azure | 36 |
| Enameloid, sky blue | 31 |
| Enameloid, emeral green | 29 |
| Flat tone, shell pink | 57 |
| Enameloid, pink | 51 |
| Enameloid, cardinal red | 27 |
| Enameloid, wine | 12 |

The percentages are the results of some tests conducted by the National Lamp Works of the General Electric Company with gas-filled tungsten-filament lamps. The figures are also fairly correct, however, with vacuum tungsten and "daylight" gas-filled lamps.

*These tests apply to Sherwin-Williams paints.

# CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

## IOWA CENTRAL STATION MAY STUDY INSURANCE

**Risks Created by Farm Lines Are Not Acceptable to Old-Line Insurance Companies, so State Utility Association May Act**

Liability for property damage is a very real risk which is faced by central stations that are operating farm lines. At least this is the opinion of Iowa central station operators who have suffered some small losses and who have had some narrow escapes from some larger ones.

One operator who has been trying to get insurance to cover this risk stated that most insurance companies refused to accept the business. The rates at which it would be accepted by a few were prohibitive. At his suggestion the executive committee of the Iowa Section, National Electric Light Association was authorized to appoint a committee to study this risk and to see if some group plan of insuring a number of central stations could not be worked out in a manner satisfactory to an insurance company that might take the business.

## NEW YORK EDISON CREATES COMPANY DEVICE BOOSTERS

**Methods Used to Interest Employees of All Departments in Electrical Household Appliances and the Promotion of Their Use**

Coöperation, informal and indirect, of all the members of a central-station company, whether in the sales division or not, is essential to the thorough-going success of any sales-appliance campaign. For instance, there is the meter reader who believes that electric flatirons are responsible for all arguments. "Your bill running high, ma'am? Isn't that a flatiron I see over on the shelf? Of course your bill's high. Why, that thing just eats current," etc. Nor should the meter reader be singled out especially; any member of a central-station force who doesn't really believe in electric household appliances is a possible source of trouble. Starting from this point, the home economics bureau of the New York Edison Company makes a special drive not only to "educate the public" but also to convert into an auxiliary selling force as many as possible of the company employees not directly concerned with the sale of electric household appliances.

This is done by making household appliances useful to as many members of the company as possible, not forgetting their wives. For instance, during summer months, when the home economics bureau is running canning demonstrations daily in the various branch offices of the company throughout the city, employees are invited to bring in their fruit and vegetables and have them put up. A man in any department may bring in his beans or his blackberries and on furnishing the jars, and sugar when necessary, may have all his canning done free of charge. Is it not reasonable to believe that when that man brings home those neat jars, all completed, his wife will show them to her neighbors and tell how they were done in an electric fireless cooker? Earlier in the spring employees were invited to bring in their fine curtains and have them done in the electric washing machines; later blankets and small rugs were also accepted. The material was all needed for laundry demonstrations, and the housewife whose blankets and curtains were returned in first-class shape became an active advocate of electric washing machines.

Even the humbler members of the force are not overlooked. The office boys of the Edison company have their own boy-scout organization with flags, uniforms and other equipment. When the flags were seen to be in need of attention the home economics bureau offered its services, and after a brief sojourn in the washing machines the flags were returned resplendent as before. Very soon afterward the boys wanted to know if something could be done for their scout caps, and it was.

Thus in these and a dozen other ways a continual effort is made to keep before all the employees the usefulness and superiority of electric household equipment, another form of "begin-at-home" advertising.

## SELLING IDEA OF SERVICE TO COMPANY'S EMPLOYEES

**R. S. Torrance Says This Is Secret of Getting Consumers' Good Will—Executives Should Study Their Men and Teach Them to Study the Public**

Good will toward a utility depends largely upon the impression its employees make on the public, and consequently the latter should be taught to treat the company's patrons as they would wish to be treated, said R. S. Torrance, district manager at Eau Claire, Wis., of the Wisconsin-Minnesota Light & Power Company, in a paper which he read at a recent meeting of the company's managers at La Crosse.

The men in a public-service organization that can do it the most harm or, on the other hand, the most good are, says Mr. Torrance, the meter reader, the complaint clerk and the troubleman. These are the company's representatives who actually go into the homes and places of business of its customers. From their demeanor to a greater extent than from any other source the public will judge the company. Too little attention is paid to the way these men treat the public, and too few companies see to it that their representatives have a knowledge of the appliances they are called on to adjust. There is no inquiry into the methods, or, rather, the lack of methods, which these men use to ex-

plain a customer's trouble to him so that the customer may learn to help himself in the future.

Mr. Torrance thinks that all utility executives, from president to foreman, should study their men, particularly those coming in contact with the public, with a view to teaching them to study the public in the same manner and to treat the public in the same way in which they would like to be treated. The executives must "get over" the idea of courteous service to their men so that the latter may "get it over" to the company's patrons. This "getting it over" to the utility's employees is in reality a sales job, says Mr. Torrance. Those in authority must sell the idea of service to their men, and then the men will in their turn impress it upon the public.

"How shall we sell our men these ideas of service?" asks Mr. Torrance. He goes on to say that the selling of service ideas should be carried out not only with the men who enter customers' homes but with every member of the organization. This applies particularly to those handling complaints. The attitude of the customer toward a utility is largely determined by the manner in which his complaint or inquiry is received. There is no estimating the good that can be done by the voice that talks with a smile. The average customer, in Mr. Torrance's opinion, has a secret belief that the company is trying to "put something over" on him.

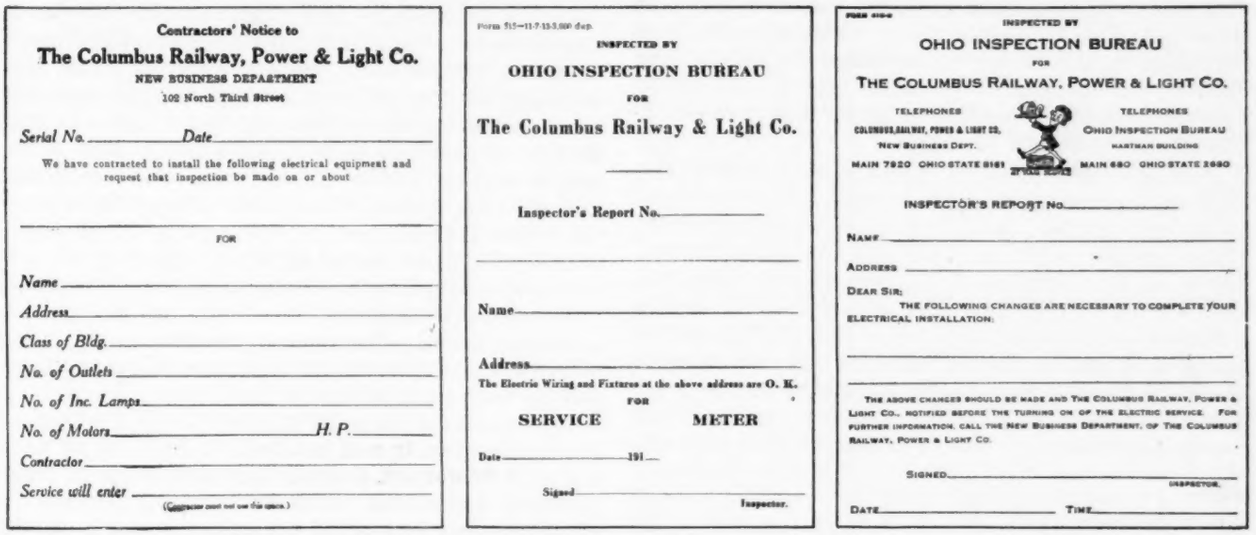
This misconception arises from the fact that no matter what class of service the utility is rendering, the service is intangible. The customer does not see the gas that he burns or the electric energy he uses and so does not understand how something that is invisible can be measured. He therefore regards the meter as an infernal machine designed to rob him. This suspicion must be overcome, and the best way to do this is to educate the public in the A B C of the business. The company's own representatives are the logical agents for this work, and hence should themselves be taught at least the rudiments of the subject.

Regularity in meter reading is very important in establishing confidence. Many complaints are received concerning high bills, bills incorrectly made out or bills covering wrong periods. This is a phase of the business demanding constant attention. In many cases bills are rendered covering irregular periods, and the customer, without looking into the matter, comes to the conclusion that the company is trying to "do" him. The establishment of 100 per cent efficiency in meter reading would do away with this source of complaint.

## RECORDS OF CUSTOMERS OF COLUMBUS COMPANY

### Usefulness of Form Furnished by the Central Station to Contractors Facilitating the Work of Inspection to Assure Prompt Service

The system of records of customers used by the Columbus (Ohio) Railway, Power & Light Company includes a form which is furnished by the company to contractors. It is made out in triplicate—white, yellow and pink sheets—and two copies are sent to the new-business department and the third retained by the contractor. The central-station company places one of its copies in the preliminary file and forwards the other to the bureau of inspection. This provides for prompt work on the part of the inspectors, since the forewarning allows them to schedule the house for inspection ahead of time and necessitates little if any delay between completion of the work and inspection "O. K."



Contractors' Notice to
The Columbus Railway, Power & Light Co.
NEW BUSINESS DEPARTMENT
102 North Third Street

Serial No. _____ Date _____

We have contracted to install the following electrical equipment and request that inspection be made on or about

_____

FOR

Name _____
Address _____
Class of Bldg. _____
No. of Outlets _____
No. of Inc. Lamps _____
No. of Motors _____ H. P. _____
Contractor _____
Service will enter _____

Form 515—11-7-13-5,000 dep.
INSPECTED BY
OHIO INSPECTION BUREAU
FOR
The Columbus Railway & Light Co.

Inspector's Report No. _____

_____

Name _____

Address _____

The Electric Wiring and Fixtures at the above address are O. K.
FOR
SERVICE METER

Date _____ 191__

Signed _____
Inspector.

INSPECTED BY
OHIO INSPECTION BUREAU
FOR
THE COLUMBUS RAILWAY, POWER & LIGHT CO.

TELEPHONES
COLUMBUS RAILWAY, POWER & LIGHT CO.
NEW BUSINESS DEPT.
MAIN 7920 OHIO STATE 8161

TELEPHONES
OHIO INSPECTION BUREAU
HARTMAN BUILDING
MAIN 680 OHIO STATE 2680

INSPECTOR'S REPORT No. _____

NAME _____
ADDRESS _____
DEAR SIR:
THE FOLLOWING CHANGES ARE NECESSARY TO COMPLETE YOUR ELECTRICAL INSTALLATION:

_____

_____

THE ABOVE CHANGES SHOULD BE MADE AND THE COLUMBUS RAILWAY, POWER & LIGHT CO., NOTIFIED BEFORE THE TURNING ON OF THE ELECTRIC SERVICE. FOR FURTHER INFORMATION, CALL THE NEW BUSINESS DEPARTMENT, OF THE COLUMBUS RAILWAY, POWER & LIGHT CO.

SIGNED _____
INSPECTOR.
DATE _____ TIME _____

TRIPLICATE SYSTEM OF CUSTOMER RECORDS USED BY MIDDLE WEST CENTRAL STATION

When the Ohio Inspection Bureau makes its first inspection, the form furnished to it by the electric company is made out in triplicate. One copy is left on the premises for the contractor, the second copy is mailed to the electric company and placed in the preliminary file, and the third is retained by the inspector. This is followed by a form which, if the work is entirely completed, is simply signed by the inspector; but if the house is O. K. for meter but not for service, or vica versa, the work not yet O. K. is marked out and the notice finds its way to the preliminary file.

By this means the electric company can keep its part of the work done, so far as the O. K. notice goes, and be ready to supply the service at the earliest possible moment. With these various preliminaries, it is usually only a matter of a very few hours after the customer comes in for his contract before he can have electricity at his command.

# DIGEST OF ELECTRICAL LITERATURE

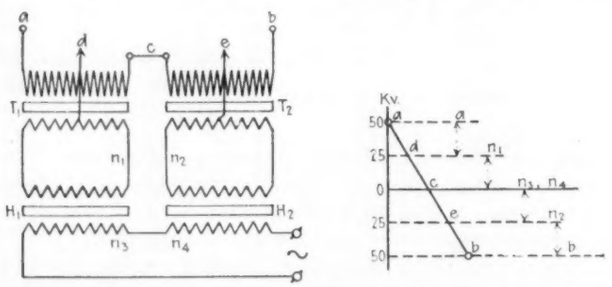
## Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

### Generators, Motors and Transformers

*Parallel Operation of Transformers.*—E. G. REED.—In order that two transformers may operate satisfactorily in parallel, secondary voltages must be equal in value and in time phase. The writer discusses load division of transformers when connected in parallel and the use of balance coils for proper load division.—*Electric Journal*, June, 1919.

*Power Transformers.*—A. F. BERRY.—The author calls attention to the great variety in the requirements that must be met in transformer designs. He states that in construction good workmanship is of the greatest importance, and this applies equally to repairs, a fact which is sometimes neglected. In conclusion he draws attention to certain points which are sometimes forgotten in the design of buildings for substations, such as the desirability of being able to run trucks into the building, necessitating ample headroom.—London *Electrician*, June 27, 1919.

*Dessauer's High-Tension Transformer.*—E. WALTER.—In work connected with Röntgen rays very high pressures are required, even higher than 200,000 volts. There are two usual forms of transformers in Röntgen ray work, that with closed and that with the open iron core. With an open iron core some difficulties are introduced owing to air bubbles in the insulating compound used causing corona discharge and also owing to direct discharge between coils, a difficulty which is not readily remedied. With closed iron cores the conditions are rather different. They are usually filled with oil.




DISTRIBUTION OF POTENTIAL WITH DESSAUER'S CONNECTION

The necessary distance from the iron yoke and the high-tension winding is only to be obtained by increasing the dimensions. The difficulties are very great with spark gaps of 30 cm. or 40 cm., and they can be overcome only at great cost. Discharges through the oil may lower its insulating qualities. In the Dessauer system the transformer is divided into several component transformers so as to decrease the strain on the insulation of each transformer. In the figure such an arrangement is shown. There are two high-tension transformers, $T_1$ and $T_2$, and two stress transformers, $H_1$ and $H_2$. The primary windings of the two latter transformers are in series, as are also the secondary windings of the two high-tension transformers, which are earthed at the middle point $C$. Let us suppose the secondary voltage to be 100 kv.; thus $a$ is 50 kv. above earth and $b$ the same amount below. Let us now suppose the middle point of the high-tension winding $e$ and $d$ to be joined to the corresponding points on the primary windings of the high-tension transformers. Then each of these primary windings, as well as secondary windings of the stress transformers, which are connected with them, have the potentials of the points $d$ and $e$. The distribution of the pressures is shown in the illustration at the right. In the present case $c$ is at the potential of earth. The points $d$ and $e$, as well as the primary windings of the high tension-transformers and the secondary windings of the stress transformers, are 25 kv. above or below earth. The ends of the high-tension windings at $a$ and $b$ are 50 kv. above or below earth, but differ only by 25 kv. from the corresponding primary winding and the iron core. The maximum stress is thus only 25 kv., the total pressure being supposed to be 100,000 volts. This advantage is obtained at the cost of two stress transformers and a double system of transformation. The cost of the stress transformers is very small. They can be wound with a few turns of thick wire, a closed iron yoke and oil insulation. Seeing that the stress in the high-tension transformer is halved, the cost will be more than halved. Consequently the new system is very little more expensive than the old for moderate voltages, and on very high voltage it is cheaper. There is no comparison from the point of view of safe working. A further decrease in cost can be brought about by using a third transformer, because then a third stress transformer is not needed. This arrangement also has the advantage that in case of a breakdown only a portion of the apparatus will be injured, and if the broken-down portion is cut out of action the rest is serviceable for operation at a lower pressure.—London *Electrician*, July 4, 1919.

### Lamps and Lighting

*Quartz Lamps for the Treatment of Tubercular Patients.*—A. GRADENWITZ.—An artificial light treatment is produced in a room in which the patients can walk about. The lamps are suspended along the walls a few feet from the ground and the walls and ceiling are covered with materials that reflect ultra-violet rays. Some details of the installation and mode of treatment are given.—*Technical Supplement Review of Foreign Press*, June 24, 1919. (Abstracted from *Schweiz. Elektrot. Zeits.*, May 10-17, 1919.)

*Lighting Installation for a Church Auditorium.*—H. O. STEWART.—The lighting system provided for Asbury Methodist Church in Rochester, N. Y., is here explained. The illumination is obtained principally by the use of indirect luminous bowls, with concealed sources for the direct lighting of platform.—*Electrical Review*, July 5, 1919.

*Chemistry and Chemical Control in the Lamp Industry.*—ALBERT BRANN and A. M. HAGAMAN.—The writer discusses the chemical problems incident to the production of filament of proper characteristics. He tells the necessity of obtaining the purest molybdenum for the use of supports in incandescent lamps. The use of "getters" in the prevention of the blackening of the bulb is explained and the physical properties of glass used in the manufacture of the lamp are discussed.—*Electric Journal*, May, 1919.

*Gas-Filed Lamps for Motion-Picture Production.*—A. R. DENNINGTON.—It is said that lamps rated at 30 volts and 30 amp. have been adopted as standards for motion-picture projections. At the present time several types of lamp-house equipment and electric control devices have been developed which are sufficiently simple, rugged and reliable to insure a rapid increase in the use of incandescent lamps for projecting pictures. The writer shows how the reflector is used to give satisfactory intrinsic brilliancy to the coils of lamp filament which are mounted within the lamp.—*Electric Journal*, May, 1919.

### Generation, Transmission and Distribution

*Varnished-Cambric Cable for Underground Service.*—W. E. HAZELTINE.—The writer describes the varnished-cambric cable and points out the features wherein this cable is superior to those of the rubber-insulated or paper type. As varnished-cambric cable for underground service is less liable to break down than paper-insulated cable, it is particularly suitable for the lines of the small operating companies, it is said, since these have not the interconnected network of the larger companies, nor can they afford the maintenance of a large cable repair force and cable stock.—*General Electric Review*, June, 1919.

*Investigations on Bucket Turbines.*—E. REICHEL and W. WAGENBACH.—In an earlier series of investigations (*Zeits. Vereines Deutsch.*, 1913, p. 441) behavior of various types of buckets was examined under the same load and stress and the results compared. A complete statement is given of all the essential data, and two-dimension and three-dimension curves are plotted showing the efficiency and other operating characteristics under various conditions. Owing to the number of variables concerned, reference must be made to the original for details.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Zeits. Vereines Deutsch.*, Dec. 7, 1918.)

*Powdered Coal Plant for Hammersmith.*—It is said that a modern powdered coal fuel plant is to be installed by the Hammersmith Corporation Electricity Works, which are to operate on the Holbeck system. The cross-section of the fuel-handling plant is shown, and the progress of the powdered fuel is here seen.—London *Electrician*, June 27, 1919.

*Some Electric Transmission Considerations.*—S. L. PEARCE.—Discussing the development of transmission lines in connection with the plan for super-power stations, the author states that the location of the plant should be at the load center so far as local conditions permit. He also gives a series of items which may influence the choice of the power site. He states that with the introduction of very high voltages such as are likely to be used in the future the great disparity between overhead and underground lines largely disappears. Strategic and climatic considerations also support the use of the underground system as well as the primary consideration of reliability. He states that experimental work has demonstrated so far that a 66,000-volt, three-phase cable is both a commercial and a technical probability. The use of line cables will limit the line pressure, therefore, to approximately 66,000 volts. The author takes some specific problems and presents figures as proof of his statements.—London *Electrician*, June 27, 1919.

*The Combustion of Powdered Fuel.*—J. S. ATKINSON.—The author deals generally with the combustion of powdered fuel. Such a method has many advantages—for example, higher temperature due to smaller excess of air, smokeless combustion and no loss of combustible in the ashes. Certain precautions are necessary in arranging for suitable combustion. The details of the Holbeck system are described, and the importance of proper design of the burner is emphasized.—London *Electrician*, June 27, 1919.

*Dielectric Energy Losses in Armored Cables.*—SWYNGEDAUW.—Article describing a method of measuring dielectric losses in cables. In the case of two cables, $C_1$ and $C_2$, running between stations $S$ and $T$, the watt losses are measured in two cases: (1) with the cores of $C_1$ and $C_2$ separated at $S$ but connected at $T$ (cables in series); (2) with the cores connected both at $S$ and at $T$ (cables connected in parallel), the voltage being applied between the core of $C$ and the armoring. The dielectric losses are the same in both cases, but the conductor losses are reduced to one-quarter in the parallel arrangement. In a certain case, with a pressure of 10,750 volts, the watt losses in the dielectric were reduced from 1858 to 1000 watts when the temperature of the cable was raised 24 deg. C. by a preliminary heating current.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Comptes Rendus*, Jan. 27, 1919.)

*Steam Electric Plant of the Dominion Power & Transmission Company.*—This plant, just outside of the city limits of Hamilton, Ontario, is designed for an ultimate capacity of 75,000 kva., 25,000 kva. of which has been installed at this date. In this number the writer deals particularly with the coal-handling and boiler-house equipment.—Toronto *Electrical News*, May, 1919.

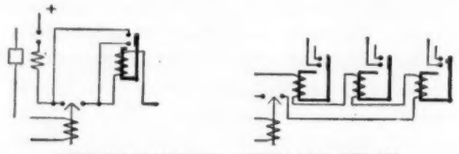
*Single-Phase Load on a Two-Phase System.*—J. B. GIBBS.—The writer discusses the best way of handling single-phase loads on two-phase systems, the principal object of which is to keep the polyphase system balanced. *Power*, July 1, 1919.

*Electric Welding, Its Theory and Practice.*—H. S. MARQUAND.—In this number of the series the author deals with the preparation of welds and then passes on to certain properties of iron and mild steels which have a marked bearing on the methods adopted. The welding of copper and copper alloys has not received very much attention, but electric welding is nevertheless applicable to such work. Finally examples are given of various types of welding.—London *Electrician*, June 20, 1919.

*European High-Voltage Switchgear.*—W. A. COATES.—The writer states that there is considerable use of draw-out switchgear in which the oil switch is movably mounted on suitable brackets and fitted with plug contacts on fixed supports. The high-voltage Continental oil switches are in general characterized by the large volume of oil they require, low operating speeds and frequently the relatively weak mechanical construc-

tion adopted. Cubicle work for housing the switches, breakers, etc., is quite similar to American practice. Practically all the Continental lightning-arrester designs hinge around the use of the horn gap originally employed by Siemens operating in conjunction with a water jet.—*Electric Journal*, June, 1919.

*Developments in Switchboard Apparatus.*—It is said that in the development of standard relay units standardization has been carried to unusual lengths. Instantaneous, inverse time-limit and definite time-limit relays are alike as far as external appearances are concerned. All relays are made from the same general parts; consequently any one of these types can be converted to one of the other two by adding or omitting the bellows or by changing the spring in the barrel which carries the moving contact mechanism. An auxiliary relay has recently been developed for many uses. In general it can be used on any direct-current circuit to close or open automatically a direct-current or alternating-current circuit of small capacity up to 600 volts. When the operating coil is energized the relay contacts close, and when current is cut off the coil the armature falls by gravity assisted by the spring action of bronze movable contacts which are under pressure when closed. In the left-hand portion of the figure the auxiliary relay is shown used in connection with an overload re-



APPLICATIONS OF AUXILIARY RELAY

lay to relieve the contacts of the latter from making or breaking comparatively large current. This is the usual connection for the auxiliary relay when used as a control or a signal relay. On the right are shown three auxiliary relays with the coils in series as used to control the automatic opening and closing of the circuit, depending on the operation of a master relay which may function on overload, reverse power or other abnormal circuit conditions. This is a scheme used when the simultaneous tripping of several breakers is desired. The auxiliary relay consists of a cylindrical coil with soft-iron core, a magnetic circuit consisting of machine-bent U-shaped and L-shaped pieces of soft iron, brass hinges for the armature contacts, terminals and insulation. The contacts open and close with a wiping motion which keeps them clean. The break is vertical, and the contacts when adjusted for maximum travel will open about 10 amp. at 125 volts, 2.5 amp. at 250 volts, and of course less current at higher voltages.—*General Electric Review*, July, 1919.

## Electrochemistry and Batteries

*Technical Utilization of Nitrogen Oxides Formed from the Air by Means of the Arc.*—H. ANDRIESSENS.—The various processes for the production of nitrogen oxides from atmospheric air are first briefly mentioned and then the theory of the reaction is discussed. The phenomena of the arc are next discussed, and it is shown that a high-voltage alternating-current arc can be drawn out to any desired degree and widened over a small reaction surface by means of the following arrangement: The two electrodes are placed very near together and a high-voltage alternating-current arc is struck. Air is blown from a tube inserted between the carbons, thus blowing the arc into the form of an inverted V, where the blast is supposed to be from below. A direct-current electromagnet is placed with its axis parallel to the line joining the electrodes. In this way the two halves of the arc will be always opposed to the lines of the field, whether the electrodes are supplied with direct or alternating current. The arc is deformed by the field in such a way that it is flattened into an extensive area bounded by a screw-shaped surface, and by bringing the electrodes within a few millimeters of each other the whole energy of the arc can be concentrated into this narrow reaction space. When 60 kw. was used in the arc, the diameter of the flame disk was about 50 cm. and was the same whether 5000 volts or 1000 volts was used for the supply. On short runs up to 95 kw. was supplied to the arc, the arc disk being then about 70 cm. in diameter, corresponding to an arc length of 2.2 m. At 1000 kw. the flame disk diameter is estimated to be about 1 mm.—*Scientific Abstracts, Section B*, April 30, 1919. (Abstracted from *Schweiz. Elektrot. Verein Bulletin*, November, 1918.)

## Telegraphy, Telephony and Signals

*Theory of Valve Rectification.*—W. S. BARRELL.—Starting with the theory of the Fleming valve, the writer develops the theory of rectification by means of this valve.—London *Wireless World*, July, 1919.

*Relays in Submarine Telegraphy.*—J. B. POMEY.—Is wireless telegraphy eventually to dethrone submarine cabling? The author asks this question, but does not venture categorically to answer it. Instead he describes the improvements in cable operation instituted in recent years by which it has been made possible to transmit from 120 letters a minute to as many as 300, or when the duplex system is employed 80 per cent more than these numbers. These results are due to the amplifiers of Heurtley and Orling, which are described, as is the Ader receiver. The cable relays of S. G. Brown, which permit messages to be translated at intermediary stations, are described at length, as are also the vibration relay of K. Gulstad, the resonance receiver of Blondel and the hydrodynamic resonance receiver of Charron.—*Revue Générale de l'Electricité*, May 31, 1919.

*The Poulsen System of Wireless Telegraphy.*—G. PESSION.—The earth resistance obliges us to construct enormous antennas in order to obtain reasonable transmitting efficiencies when large powers are required. The author remarks that a reduction of the size of the transmitting antennas will only be possible when an antenna is discovered for which the earth resistance will be sufficiently low. Details of the installations from the points of view of the manipulation of the insulation and the influence of the inductance inserted in the aërial upon the adjacent bodies, etc., are given. The efficiency of the arc measured by the author attains about 50 per cent. It was observed that in certain cases a condenser of convenient capacity shunting the arc increases both the efficiency and the power obtainable from it; this phenomenon is not yet quite explained. A roughly approximate formula for determining the pressure $E$ at the arc, when the intensity of the direct current $I$ and the resistance $R$ of the oscillating current are given, is the following: $E = RI$. This formula was found very useful in establishing new stations.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Jahrb. d. Drahtl. Tele.*, 13, 1918.)

# *Scientific and Industrial Research*

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

*Conducted by* PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

## TECHNICAL RESEARCH— THE MAN AND THE JOB

### Qualities of the Research Man Are Outlined—Industries Should Employ Good Research Directors and Give Them a Free Hand

In outlining the characteristics of the real research man a recent correspondent of the London *Electrician* (July 4, 1919) says the researcher is a "big" man and should be extremely useful in the industries. Some of the forceful remarks of this writer are as follows:

"He is born, not made. He has the creative gift, the faculty of seeing new combinations and possibilities where the most accomplished technician without the gift sees only known ones. He has a first-class education in pure science and a wide experience in works. He has further taken the trouble to master the technique of business, costing and selling. Good if he has managed a department and had to make it pay. He retains in spite of all this so incurable an interest in experimenting that he is willing to sacrifice the joys and emoluments of managerial power to it. Not the man who is no use anywhere but in the 'lab,' but the man who prefers the laboratory in spite of prospects of success in management—that is the man you want; or the consultant who is earning a good, if precarious, living at all sorts of small jobs and taking out ingenious patents which he has neither time, means nor opportunity to develop to full success. Many such a man would be worth his money ten times over to a firm which would tempt him with salary and prospect of royalties to stay and devote himself to mastering thoroughly one branch of technical work and being in the very forefront of that. It is pure nonsense to represent German industrial research as the work of dull, patient, uncreative plodders—the kind of people a Briton will not descend to being. To the men of ideas are given plodders to work for them, but a man of proved creative capacity is sought after, you might almost say courted. . . . The German firms pay the doctors to keep them well; the English only call in the expert when they are driven to it and half a dozen totally incompetent persons have wasted the firm's money on trying to solve the problem."

## Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

COMMODITIES, DISPLACEMENT OF.

A comprehensive list has been compiled of commercial commodities arranged alphabetically, giving the weight per cubic foot, cubic feet per short ton, cubic feet per long ton, and in many instances how the commodity is packed for shipment. It is primarily intended for use in estimating cargo and warehouse space required. This work was done in response to many inquiries from various branches of the government as well as from private sources. The table will be revised and enlarged from time to time as further data are obtained.—*H. M. Roeser and Lillie E. Johnson, Bureau of Standards, Washington, D. C.*

COMPASS, ATTACHMENT FOR READING AT A DISTANCE.

Considerable difficulty has been experienced with steering airplanes in a dark night or in a fog, by means of a magnetic compass, on account of its being affected by the iron masses of the engine. The writer was asked by the Naval Consulting Board to devise an arrangement such that the compass could be placed in the rear of the fuselage, away from the engine, and read by the pilot from the distance. On account of an exceedingly small torque no contact arrangement could be attached to the needle, and recourse had to be had to an electric spark playing between the moving and the stationary part of the compass. An ordinary vibrator used for ignition on a Ford car was used for the source of spark, and two Geissler tubes were placed in front of the pilot, connected to the compass by electric wires. The aviator could set his course on the compass by means of a long rod with a rack and a pinion, thus setting the electric contacts in the proper position. As soon as he would deviate slightly from this course, either one or the other tube would light up in front of him. All he had to do was to steer the machine in such a way as to keep both tubes lighted at the same time.—*V. Karapetoff, Cornell University, Ithaca, N. Y.*

FREQUENCY CONTROL.

Actual practice extending over more than two years has demonstrated that the speed-regulating characteristics of modern turbine governors are so excellent that with occasional manual correction the average frequency of a large power plant may be maintained with the accuracy of an excellent clock. A thoroughly reliable miniature self-starting synchronous motor has been developed. This has been incorporated in instruments to enable the maintenance of frequency with the required precision, and also in many kinds of time-measuring devices, such as clocks, graphic meters, etc., to utilize the new kind of service. A new field of usefulness for commercial alternating current has thus been made available. For details see A. I. E. E. *Proceedings*, May, 1919, p. 629.—*Henry E. Warren, Ashland, Mass.*

INSULATING MATERIALS, MECHANICAL PROPERTIES OF.

On test samples cut from the same sheets that were used for the measurements of certain electrical properties, measurements have been made of the principal mechanical properties of the same insulating materials. Previous tests of this sort have been worth little because they have generally been on isolated samples and have not been coördinated with other properties of the same materials. Often, too, the method or procedure of measurement has been open to doubt. The facilities of this bureau for a wide range of physical measurements have made it possible to secure reliable data on the mechanical as well as electrical, thermal and other properties. Work is to be continued on the mechanical properties of the laminated phenol materials, bakelite-dilecto, etc. The properties measured are tensile and transverse strength, hardness as a function of temperature, thermal expansivity, brittleness, warping, density, and moisture absorption. The relations between these properties and coördination of these with the electrical properties will shed much light on the nature of the materials and their adaptability to various uses.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

MARBLES, PHYSICAL AND CHEMICAL TESTS ON.

Extensive tests are in progress on some fifty-two different types of marbles produced in this country for the purpose of determining their relative value for building purposes and for special uses. Among other tests, electrical conductivity tests have been made to determine the value of different samples as insulators under variable conditions of moisture. The results show a considerable range of values, indicating that there is a choice of marble for use in switchboards and allied purposes. Measurements of the thermal expansion show that marble does not expand at a uniform rate even at ordinary temperatures, but that the rate of expansion increases with the temperature. Moreover, when expanded by heating marble does not contract to its original dimensions as the temperature is lowered, but retains a part of the increase permanently. With a number of successive heatings each adds an increment to the length of the specimen.—*D. W. Kessler, Bureau of Standards, Washington, D. C.*

OSCILLATIONS, TRANSIENT.

The problem has been investigated of the current in an electrical network or transmission system that is produced in response to a suddenly applied emf. of arbitrary form. A simple formula has been derived which expresses this current in terms of two independent functions, viz.: (a) the applied emf. expressed as a time function and (b) a characteristic function of the constants and connections of the system. This latter expression has been termed the "indicial admittance" of the system. A knowledge of the indicial admittance completely determines the behavior of the system for all types of applied voltages, including both transient and steady states. A systematic investigation of methods for solving and computing the indicial admittance has been made, and solutions have been derived for transmission and artificial lines involving integral equations. This latter method is particularly well adapted to handle the difficult problem of taking into account the effects of terminal impedances in transmission systems. The results of this investigation were presented before the A. I. E. E.—*John R. Carson, American Telephone & Telegraph Company, New York City.*

PYROMETER, OPTICAL, ABSORPTION GLASS FOR.

Requirements have been investigated for a pyrometer absorption screen which, when used with an ocular light filter, will give a temperature scale independent of the variations in color between the eyes of different observers using the same instrument. Theory indicates that the log of the transmission of any wave length should be proportional to the exponential

of the reciprocal of that wave length. This property has been realized in some of the colored glasses produced by the Corning Glass Company.—*Foote, Mohler and Fairchild, Bureau of Standards, Washington, D. C.*

RADIO DETECTORS, RECTIFICATION IN.

The current produced in a telephone receiver connected to a radio detector is proportional to the square of the impressed radio-frequency voltage, provided that this is not too large. This current may be regarded as due to a rectified voltage generated in the detector, and the action may be quantitatively described by reference to a rectification constant of the detector, defined as the quotient of the rectified voltage divided by the square of the impressed voltage. A study is now being made of a method for measuring this constant directly, particularly in the thermionic or audion-type detector. The constant should also be capable of being derived from the characteristic curve of the detector, provided that this is followed at radio frequencies. It is proposed to determine whether such is the case.—*L. A. Hazeltime, Stevens Institute of Technology, Hoboken, N. J.*

RELAY, DIFFERENTIAL, FOR TRANSFORMER PROTECTION.

The relay is in the form of a Kelvin balance with one moving coil at each end and with one stationary coil at each end placed above the moving coil and connected to repel it. The two left-hand coils are fed from the current transformers in the primary winding of the main transformer, and the two right-hand coils from the current transformers in the secondary winding. The moving element is hung in only slightly stable equilibrium (at no load) and in a position giving relative clearances at the ends between the coils such that when currents are applied which are of the correct ratio at any intensity, the position of the moving coils will not be disturbed. Any departure from the normal ratio of currents deflects the moving arm which causes the contacts to close, and thus the defective bank of power transformers is tripped out on both sides. This system does not necessitate the choosing of current transformers to suit the ratio of the power transformer, and does not require an interconnection of the secondary circuits of the current transformers. A small time element is provided to avoid tripping off a bank on an initial rush of current when first switched on or off a line short circuit.—*H. S. Baker, Hydro-Electric Power Commission of Ontario, Niagara Falls, Ont.*

TRANSFORMERS, CURRENT, MAGNETIZATION OF.

Special tests have been performed on current transformers to determine the effect of magnetization upon the ratio and phase angle. The effect of magnetizing was investigated by three different means, namely, (1) by opening the secondary circuit with full rated current in the primary circuit; (2) by passing ten times rated current through the primary circuit with the secondary circuit closed through a resistance that represented full load for the transformers; (3) by passing rated direct current through the secondary winding. From somewhat scanty results it appears that magnetization due to an excessive current overload with the secondary closed, or due to the passage of direct current through the windings, is more severe than that caused by opening of the secondary in the load. The committee feels that this matter should be further investigated.—*N. E. L. A. Committee on Meters.*

TRANSFORMERS, POTENTIAL, CALIBRATION OF.

In November, 1917, the writer presented a paper on the calibration of current transformers before the Toronto Branch of the A. I. E. E. (printed in the A. I. E. E. *Proceedings*, September, 1918). A similar method has been in commercial use for some years for the calibration of potential transformers as mounted on the customers' premises or in the laboratory before installing. The method is a modification of the potentiometer method used by the Bureau of Standards. Four wattmeter readings are taken which determine two vector differences in potential between the secondary of the transformer under test and the potentiometer tap. These two points determine the locus of the end point of the vector of the voltage difference and hence determine the ratio and the phase error of the transformer under test. Two test cases showed agreement with the certificate of the Bureau of Standards to one-tenth of 1 per cent in the ratio and 2½ minutes on phase error. The distortion of the potentiometer ratio and the phase error due to current in the tap connection are automatically taken care of.—*H. S. Baker, Hydro-Electric Power Commission of Ontario, Niagara Falls, Ont.*

WELDING MACHINE, ELECTRIC, FOR SPOT WELDS.

A heavy experimental spot-welding machine has been built by the General Electric Company, with a capacity of 100,000 amperes at 20 volts and capable of exerting a hydraulic pressure of 36 tons at the electrodes. A careful series of experiments are being carried out with this machine using plates of from ¼ in. (6.4 mm.) to 3 in. (7.6 cm.) total thickness, and it has already been demonstrated that satisfactory spot welds can be made within this range. Owing to the necessity of providing a gap large enough to deal with the width of plates required in ship work, a number of practical difficulties were encountered in the design of the machine. One important development in this connection has been the elimination of the variable reactive drop caused by the varying inductance in the circuit due to the width of the plate. This necessitated a change in voltage for different widths, but by using two sets of electrodes and two transformers, one on each side of the work with leads direct to the electrode on the same side, the secondary windings of the transformers are in series and the effect of varying widths of plates is eliminated. Moreover, the total reactive drop is greatly reduced, which permits of a corresponding reduction in the size and weight of the transformer and generating apparatus. With the two sets of electrodes two spots are welded at a time, or a dummy can be placed between the second pair of electrodes if necessary.—*From a statement by H. Jasper Cox, of Lloyd's Register of Shipping, at a meeting of the Society of Naval Architects and Marine Engineers.*

WIRE ROPE, MAGNETIC TESTS ON.

For some time we have been studying the possibilities of applying magnetic tests for the estimation of the mechanical properties of steel, and the question of wire ropes has been considered. So far our experimental work on this subject has been of a very preliminary nature and conclusive data have not as yet been obtained. We believe that eventually a method may be devised for examining wire ropes by magnetic means which will make possible the detection of faults such as broken strands or strands which have been stressed beyond their elastic limit.—*E. B. Rosa, Bureau of Standards, Washington, D. C.*

## Suggestions for Research

ARC FURNACES, EFFECT OF DISTORTED CURRENT UPON TELEPHONES.

A certain amount of apprehension seems to exist among telephone engineers when a large arc furnace is being connected to the power lines paralleling their lines, on account of a distorted wave form of the current taken by the furnace. Cases are known in which telephone companies have entered protest in advance of furnace installations, claiming that the higher harmonics in the furnace current would cause an inductive interference in their telephone lines. Where the furnace current is small as compared to the total line current, this fear seems to be unfounded, but accurate experiments are desired under the actual service conditions, in order to determine the limiting conditions under which the telephone service may be affected.—*Editorial Suggestion.*

EDDY CURRENTS CAUSED BY OPEN SLOTS.

It is desired to investigate the exact effect of open slots in producing eddy currents in pole faces. There are two main cases to consider: (1) the case in which the magnetic field is mainly produced by the pole itself, and (2) the case in which the magnetic field is produced partly by the pole and partly by three-phase currents carried by conductors in the slots. There have been several attempts at deducing losses from theoretical consideration, but as the necessary constants cannot be readily determined, the only possible way is to attack the subject by experiment, and this is rather a costly matter.—*Miles Walker, College of Technology, Manchester, England.*

INSULATORS, DEPOSIT ON.

On our 25,000-volt installations, in the neighborhood of electrical furnaces and chemical plants, there is a deposit which collects all over the surface of the insulator, resulting in the final breaking down of this insulator with an interruption of service. We have often thought of the design of an insulator such that there would be sufficient dead air space to prevent the fumes from reaching the surface in sufficient quantities to form a deposit. We have tried using higher voltage insulators having a greater leakage surface, but this simply extends the time necessary for the deposit to collect, and does not remedy the difficulty. We have some installations which are insulated for a 60,000-volt working pressure operating under 25,000 volts, and it is necessary to clean the insulators at least once a month to prevent interruptions. There may have been some development along this line, but so far we have been unable to find anything to meet our conditions.—*J. E. Thomas, West Penn Power Co., Pittsburgh, Pa.*

LAMPS, MAGNETITE, DEPOSIT ON REFLECTORS.

Hard deposit is formed on the reflecting surface of reflectors and it often becomes rigidly attached to or burned into the porcelain. There seems to be no simple method available for preventing or cleaning this deposit. One large operating company reports that it carries extra reflectors and soaks the dirty ones in warm water for days at a time, after which they are scrubbed with a hard brush, sand, special powder, etc. The subject is worth while investigating, either with the view to preventing the deposit, making it less adhesive, or finding a simpler method of cleaning.—*Editorial Suggestion.*

OSCILLOGRAPH, DISTINCT RECORDS.

When two or three curves are recorded simultaneously on a film, it is sometimes difficult to distinguish between them. This could be remedied if one of the lines were dashed or dotted. One method of achieving this might be to cut off the light from one of the mirrors at short intervals by means of a sectored disk revolving in front of it. The same result can probably be obtained in a number of different ways, and it would be convenient to develop a simple attachment which could be used whenever there is a danger of a confusing record.—*Editorial Suggestion.*

PYROMETER, FOR MOLTEN BRASS AND ALUMINUM

Some difficulty is experienced with measuring temperature of molten brass in foundry work. All the known "unprotected" thermocouples seem to be affected by brass and disintegrate rapidly. Protected thermocouples are too slow; one has to wait a few minutes before the thermocouple reaches its final temperature equal to that of the metal. A thermocouple is wanted which is sufficiently exposed so that a quick reading may be taken, and at the same time is not attacked by molten brass. The same applies to some extent to aluminum, except that the temperature is not so high.—*Editorial Suggestion.*

SWITCHES, HIGH-TENSION, HIGH-CAPACITY.

In the new one-million-horsepower electric plant under construction near Queenston, Ontario, in which practically the full head of over 300 ft. (90 m.) between Lakes Erie and Ontario will be utilized, each of the first four three-phase generators will have a rating of 45,000 kva. at 12,000 volts. The problem of switching such a tremendous amount of power presents serious difficulties and an improvement upon the present types of oil switches would be of great benefit for an uninterrupted operation. As soon as a fault has developed on the buses or beyond, an ideal switching arrangement should instantly begin to introduce some resistance and reactance into the faulty circuit, gradually or in steps, and thus cut the current down to a reasonable amount before opening the circuit.—*A. H. Hull, Hydro-Electric Power Commission, Toronto, Ont.*

TRANSMISSION LINES, LOCATION OF FAULTS.

When a long transmission line has been opened by an oil switch because of a fault or a ground, the next problem is to find the exact location of the trouble. With long lines this is quite a tedious procedure, and any improvement upon the present step-by-step method would greatly help in clearing line troubles and restoring service more promptly. In devising such methods, one must keep in mind that many faults can be discovered only at a voltage somewhere near the operating voltage, and that there may be several partly faulty insulators on the line, quite a distance apart, which together cause the switch to trip.—*W. P. Dobson, Hydro-Electric Power Commission, Toronto, Ont.*

# NEWS OF THE INDUSTRY

## Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

### NEW HOPE ARISES FOR THE WATER-POWER BILL

**Washington Reports that There Is a Chance that Early Action Will Be Taken by the Senate on Pending Legislation**

There is a movement on foot among the members of the Senate to pass the water-power bill without respect to the discussion concerning the League of Nations, inquiries concerning high cost of living and demands of railroad employees.

It is expected among Senate leaders that the water-power bill, which is known as House of Representatives resolution No. 3184, will be reported soon by the Senate sub-committee, of which Senator Jones of Washington is chairman. Senator Jones of Washington has not yet returned to his work in the Senate from his visit to Seattle, but he is expected in the capital soon.

### SALES MANAGERS AGAIN MEET FOR CONVENTION

**Resume Gatherings Suspended Since 1916 and Consider Many Subjects Affecting the Commercial Departments of the Central Stations**

The Sales Managers' Association, composed of representatives of the commercial departments of some of the larger central-station companies, held a convention at Association Island, N. Y., on Aug. 4, 5 and 6. This is the first meeting held since 1916 as the usual gatherings were abandoned in 1917 and 1918 on account of the war. J. F. Becker, United Electric Light & Power Company, presided as chairman and the following program provided much discussion with intervals for golf and other amusements during the three days.

*Monday, Aug.* 4, 11 *a.m.*—"Expense Accounts," R. S. Hale; "Merchandising Central-Station Service," J. G. Learned; "Motor Rules," R. H. Tillman.

*Monday, Aug.* 4, 8 *p.m.*—"Mazda Searchlight and Intensive Street Lighting, with Special Reference to Saratoga System," W. D'A. Ryan; "Incandescent Lamps from Manufacturers' Standpoint," S. E. Doane.

*Tuesday, Aug.* 5, 10 *a.m.*—Coördination of Central-Station Service with Private Plant Operation," L. R. Wallis; "Present Status of Isolated Plant Competition," J. W. Meyer; "Comparative Power Sales an Index of Trade Conditions," H. H. Holding; "Will Industrial Power Customers Approve Increases in Rates to Compensate for Increases in Operating Costs?" H. H. Holding; "Typical Report of a Large Office Building with Hydraulic Elevators," W. H. Whitton and H. T. Luscomb.

*Tuesday, Aug.* 5, 8 *p.m.*—"Advertising," L. D. Gibbs; "Merchandising Electric Appliances," E. A. Edkins; "Some Observations on Growing Tendency Toward Restriction of Central Stations in Electric Merchandising," G. E. Miller.

*Wednesday, Aug.* 6, 10 *a.m.*—"Merchandising Incandescent Lamps," T. I. Jones; "Delivering High-Tension Service to Large Consumers," Rawson Collier; "Brass Furnaces," J. D. Noyes.

*Wednesday, Aug.* 6, 2.30 *p.m.*—Open discussion and organization meeting.

*Topics for Discussion.*—Examination of salesmen on rate question; rules of applying the use of electricity to customers on the off-peak contracts; coöperation between the contractor, jobber, manufacturer and central station; compensation and education of different classes of salesmen; financing wiring, motors and household appliances; possibilities of electric heating appliances in the commercial field, and the service necessary to keep same in operation; a system for looking over the unused meters; interbuilding connections; the methods of actually imposing a power-factor penalty.

T. I. Jones, Edison Electric Illuminating Company of Brooklyn, was elected chairman for the ensuing year. The members elected for the executive committee. in addition to Mr. Jones, are Miss Sarah M. Sheridan, Detroit Edison Company, and R. H. Tillman, Consolidated Gas, Electric Light & Power Company of Baltimore.

### EXECUTIVE COMMITTEE OF THE N. E. L. A. COMMERCIAL SECTION

**Meeting at Association Island, N. Y., Gives Strong Impetus to Plans for Enlargement of the Scope of Activities**

The executive committee of the Commercial Section of the National Electric Light Association met at Association Island, N. Y., on Aug. 7 to 9. There was a full attendance and the plans for the work proposed for the coming year were gone over in detail. It is proposed to enlarge the scope of the activities of the section substantially. Opportunities for active development of the commercial departments are so encouraging that many lines of progress will be followed by the bureaus and committees of the section in preparation for the 1920 convention.

### SOUTHEASTERN SECTION IS TO MEET AT ASHEVILLE

**Tentative Program for Convention on Sept. 17 to 19 Includes Address by President Ballard of the National Body**

The tentative program for the convention of the Southeastern Section of the National Electric Light Association, to be held at Asheville, N. C., on Sept. 17 to 19, follows:

*Wednesday Morning*—Address of welcome by Mayor of Asheville; president's address; address by C. Murphy Candler, chairman Georgia Railroad Commission; address, "Live Line Work," by T. F. Johnson.

*Wednesday Afternoon*—Trip to Vanderbilt estate or trip to Mount Pisgah; golf.

*Wednesday Evening*—Report of public policy committee by W. H. Glenn; address by F. G. R. Gordon on "Socialism."

*Thursday Morning*—Address by R. H. Ballard, president N. E. L. A.; address by Mr. Hamilton on rates; address by Mr. Parrish on safety code; address by J. Prince Webster, public utility attorney.

*Thursday Afternoon*—Guests of country club; tea dance; golf; airplane flight for those who wish to go; band concert.

*Thursday Night*—Moving pictures at hotel, followed by informal dance.

*Friday Morning*—Address on "Grounding of Secondaries," by Mr. Sutton; executive committee meeting.

Entertainment for the ladies has been provided in the form of auto rides, dances, etc.

## TRIBUTE TO CARNEGIE BY ENGINEERING SOCIETIES

### Nationa Organizations Take Action to Express Their Regret at the Death of Benefactor Who Made Possible Their Imposing Home

A meeting of representatives of the large national engineering societies was held on Monday afternoon of this week at the Engineering Societies Building, New York, to take action on the death of Andrew Carnegie. It was informal in character, owing to the short time available for calling together those who represented the engineering societies which have been benefited by the generosity of Mr. Carnegie. It was called thus soon after the death of the great ironmaster, however, in order that prompt steps might be taken to give expression to the deep regret of the engineering professions and to their tribute.

It was voted at the meeting that the following representatives of the founder societies of the United Engineering Society and the Engineers' Club be requested to attend in a body the general memorial service which has been proposed: For the founder societies, the presidents and secretaries; for the United Engineering Society, the president and former trustees; for the Engineers' Club, the president, board of directors and past-presidents.

Furthermore, the following committee was appointed to draft suitable resolutions to be spread on the record of the bodies represented and sent to the family of Mr. Carnegie: For the founder societies and the United Engineering Society, Charles F. Rand, Dr. Alex. C. Humphreys, Calvin W. Rice; for the Engineers' Club, Lansing C. Holden, Robert A. Franks, E. Gybbon Spilsbury. Mr. Rand was designated as chairman.

It was also voted that the chairman appoint four men to serve with himself as a committee to determine whether there should be a memorial to Mr. Carnegie by the Engineering Societies and, if so, what form it should take, the committee to have power to make the necessary arrangements and carry them through. The members of this committee are Charles F. Rand, Lansing C. Holden, W. L. Saunders, J. A. Bensel and Prof. Comfort A. Adams.

The Engineering Societies Building, at 29 West Thirty-ninth Street, New York City, and the home of the Engineers' Club, adjoining it in the rear and fronting on West Fortieth Street, which were made possible by the present of Mr. Carnegie, are shown in the accompanying illustration. A plan for a home for the engineering societies was submitted to Mr. Carnegie in 1895 by W. D. Weaver, former editor of the ELECTRICAL WORLD. Others made similar suggestions later. It was in 1903 that Mr. Carnegie offered to give $1,000,000 for a suitable union building for all of the societies. A year later, after it was found that a larger sum would be needed to make adequate provision for the societies, Mr. Carnegie increased the gift to $1,500,000 for the joint benefit of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the Engineers' Club. The only limitation was that the money should be devoted to erection of a building, the societies buying the land. A conference committee representing the various societies, after considering the requirements and objects of the Engineering Societies Building and the Engineers' Club respectively, allotted the sum. To the Engineering Societies Building $1,050,000 was given and to the Engineers' Club $450,000

ENGINEERING SOCIETIES BUILDING, NEW YORK

On May 8, 1906, the cornerstone of the fine building was laid by Mrs. Carnegie. Although not entirely finished, the building was ready for use on Jan. 1, 1907.

A large bronze tablet near the main entrance to the building bears a portrait of Mr. Carnegie and the words of his brief letter giving the $1,500,000. Another bronze tablet announces that the land was given by members and friends of the three founder societies. A bronze bust of Mr. Carnegie, in the library, was presented by officers of the founder societies. By the recent construction of additional stories on the building quarters were provided for the American Society of Civil Engineers. A number of other societies closely affiliated in membership and service with the national engineering organizations also have homes in the building.

## BROAD PROGRAM FOR THE ILLUMINATING ENGINEERS

### Topics of Interest in All Branches of Lighting Industry to Be Covered by Material for the 1919 Convention of the I. E. S.

A tentative list of subjects to be covered at the 1919 convention of the Illuminating Engineering Society at Chicago, Oct. 21 to 24, has been announced by the papers committee, of which George H. Stickney, Harrison, N. J., is chairman. A "high spot" in the program will be the report of the committee on progress, which will review lighting developments during the war, including, if possible, some of the new things which heretofore have not been openly discussed. "Searchlights, Their Development and Application During the War," will be another interesting subject.

A paper on "Viaduct Lighting" will describe an installation made without poles and involving an unusual and interesting method of distributing light over the roadway, with provisions for reducing glare. This is to be accompanied by illustrations and curves. The gas-lighting industry will be represented with a paper on "Gas Street Lighting, Its Present Status and Recent Developments." Recent developments in equipment and applications of electric street lighting will also be discussed.

A paper which will not be printed in advance is one on prospective lighting applications. This will point out the extensive field for the wider applications of artificial lighting.

For the industrial man there will be a paper entitled "Industrial Lighting" which will give data and descriptions of good installations recently put in under the advice of experts of important central stations. Figures on burning hours, etc., will be included. What the manufacturer says he is doing in regard to good industrial lighting will be brought out in a paper entitled "Industrial Lighting Survey."

The recent movement for lighting codes for various states has been recognized by placing on the program a symposium on the application of industrial lighting codes. State experts will give their experience in applying and enforcing these codes. Results of insurance companies' inspections will also come out. The importance of insuring industrial safety by means of wide regulations will center much interest on this topic. A message from the merchandiser to the illuminating engineer will be included in a paper entitled "Illuminating Engineering and Merchandising." This paper will tell how to encourage better lighting practice in lighting transactions. A paper on "Hospital Lighting" will bring out what illuminating engineers believe is good practice as exemplified by modern installations.

There is also enough of the technical in the program to make it well balanced. "Tests of Lighting Units" will bring out facts about photometric and illumination tests of typical units for interior lighting. "Diffusion of Light" will discuss a study of glare and diffusion in relation to practical lighting installations.

"Distribution of Light in Rooms" is an analysis of natural and artificial lighting with regard to wall finish, window openings, shading, etc. A paper on the "Reflecting Power of Paint" will contain data from careful tests of differently colored paints. "Photometry" is the title of a paper which will bring out the ingenious methods of making difficult measurements.

## APPOINTMENTS TO THE A. I. E. E. COMMITTEES

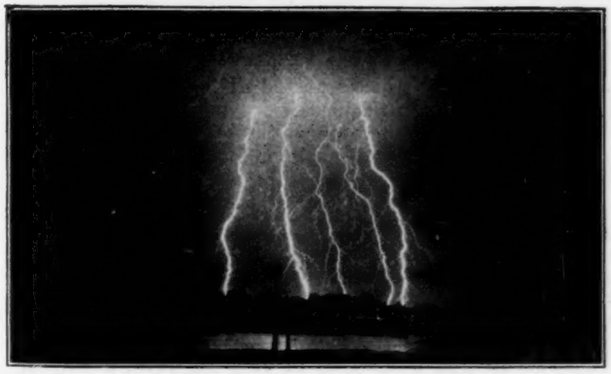
### President Townley Announces Personnel of Committees for the New Administrative Year—Chairmen Selected for the Various Classes of Work

At the first meeting of the board of directors of the Institute for the administrative year beginning on Aug. 1, 1919, held in New York, on Tuesday of this week. President Townley appointed committees for the administrative year beginning Aug. 1, 1919. The chairmen of the committee appointed are as follows:

Finance—N. A. Carle, Newark, N. J.
Meetings and Papers—W. I. Slichter, New York.
Editing—Henry H. Norris, New York.
Board of Examiners—E. L. Rhodes, New York.
Sections—W. A. Hall, Lynn, Mass.
Student Branches—C. Francis Harding, Lafayette, Ind.
Membership—R. W. Krass, New York.
Public Policy—H. W. Buck, New York.
Headquarters—N. A. Carle, Newark, N. J.
Technical Activities—Wilfred Sykes, Pittsburgh.
Standards—L. T. Robinson, Schenectady, N. Y.
Power Stations—Philip Torchio, New York.
Transmission and Distribution—E. B. Meyer, Newark.
Traction and Transportation—W. S. Murray, New York.
Industrial and Domestic Power—A. G. Pierce, Pittsburgh.
Lighting and Illumination—C. E. Clewell, Philadelphia.
Economics of Electric Service—Dr. William McClellan, Cleveland.
Protective Devices—D. W. Roper, Chicago.
Electrochemistry and Electrometallurgy—E. F. Northrup, Princeton, N. J.
Electrophysics—F. W. Peek, Pittsfield, Mass.
Telegraphy and Telephony—Donald McNicol, New York.
Marine—Arthur Parker, Camden, N. J.
Electricity in Mines—W. A. Chandler, Uniontown, Pa.
Electrical Machinery—B. A. Behrend, Boston.
Instruments and Measurements—S. G. Rhodes, New York.
Iron and Steel Industry—W. F. James, Philadelphia.
Educational—J. C. Parker, Ann Arbor, Mich.

In accordance with the by-laws of the Edison Medal committee the board confirmed the appointment by President Townley of three members of that committee for terms of five years each, namely, Edward D. Adams, New York; H. H. Barnes, Jr., New York, and Benjamin G. Lamme, Pittsburgh. The board also elected three of its own members as members of this committee for terms of two years each, Wilfred Sykes, Pittsburgh; W. A. Hall, Lynn, Mass., and G. Faccioli, Pittsfield.

## Photographing Electricity



This picture was taken recently by C. A. Kittredge, superintendent of the Bangor Railway & Electric Company's interests in Old Town, Me., at about 10:30 p.m., during the progress of an unusually vivid lightning storm.

# Report of Committee on Development, A. I. E. E.

## Full Text of Document Presented to Board of Directors at This Week's Meeting—Resolutions of the Board Approve the Recommendations in Principle and Ask Careful Consideration and Suggestions by Membership

AT A MEETING of the board of directors of the American Institute of Electrical Engineers on Tuesday of this week at the headquarters in the Engineering Societies Building, New York, the report of the committee on development was presented.

After the presentation of the report the directors adopted the following resolutions:

Resolved, that the report of the committee on development be received, with an expression of hearty appreciation of the valuable services rendered to the Institute by the committee.

Resolved, that the recommendations in the report of the committee on development, dated Aug. 12, 1919, be hereby approved in principle and that the president refer the various parts of the report to qualified committees, either existing or special, the president being hereby authorized to appoint such special committees as he deems desirable, with the request that these committees formulate definite plans of procedure, with estimates of expense involved, for bringing into effect such changes in present practice as the committees deem desirable; also that these committees give careful consideration to such additional communications as may be received from the membership relating to subjects with which the committees are dealing, these reports to be presented at the October meeting of the board.

Resolved, that the report of the committee on development, dated Aug. 12, 1919, be released for publication, with particular reference to the technical press; and that it be published in full in the next issue of the Institute *Proceedings*, with a request to the membership that the report be carefully considered and that comments upon it or additional suggestions relating to Institute activities be forwarded promptly to the secretary of the Institute, so that they may be received by him prior to Oct. 1 and be promptly referred for consideration to the various committees and officers concerned with the particular activities to which the communications may relate.

Resolved further, that the committee on development be continued, with particular reference to the consideration of the Institute's participation in joint activities with various other engineering and technical organizations, which activities are now under consideration by the joint conference committee of the development committees of several national engineering societies.

### REPORT OF COMMITTEE ON DEVELOPMENT

The report of the committee, dated Aug. 12 and addressed to the board of directors, follows in full:

The committee on development begs herewith to submit its report.

This committee was appointed by the president pursuant to a resolution of the board passed at the meeting of Oct. 11, 1918, and reading as follows:

"Resolved, that a committee on development be appointed by the president to consider suggested or proposed modifications in the field and methods of work of the Institute and to make recommendations to the board of directors concerning these matters."

I am informed that each section was invited to nominate its representative on the committee, and, owing to the delay of some sections in responding to this invitation, several months elapsed before the president was able to appoint the committee.

Subsequently, at a meeting of Jan. 10, 1919, a further resolution was passed by the board authorizing the appointment of an executive committee, viz.:

"Resolved, that the president be authorized to appoint an executive committee from the membership of the committee on development for the purpose of considering the various suggestions that may be submitted and outlining a working program for the main committee."

In a letter dated Jan. 27 the president explained what was sought to be accomplished by the creation of the committee on development and outlined a suggested course of procedure, following which, on Feb. 4, the executive committee held a meeting in New York and prepared a communication to the section members of the committee, dividing the subject to be considered into three major headings, namely:

1. The relation of the Institute to its members.
2. The relation of the Institute to other engineering organizations.
3. The relation of the Institute to the public.

Under each heading a series of questions was set up designed to bring out as full a discussion as possible and to make it clear that it was the duty and privilege of the committee to consider every angle of Institute affairs. This letter, in addition to being sent to each member of the committee on development, was published in the March *Proceedings* along with the president's letter of Jan. 27 and accompanied as well by an invitation addressed to the membership at large, whether or not connected with a section, to send in suggestions.

Attention was again called to the matter in a printed notice, mailed to the entire membership under date of March 20, in which the membership was urged to submit suggestions promptly through any member of the committee.

A subsequent reminder was addressed to the section members of the development committee announcing that a meeting of the executive committee would be held on May 8, 1919, at which time communications had been received from sixteen sections and from a number of individual members. Most of these communications showed clearly that the sections had given the matter earnest and careful study, had realized the opportunity that was being offered them and were anxious each to do its part. It was gratifying to the executive committee to find that there was such a general unanimity of opinion on many of the questions considered as to indicate very clearly the wishes of the great body of the members and incidentally to make the work of the executive committee in compiling the views of the different sections remarkably simple.

A summary of the views presented was prepared and a tentative plan of procedure outlined by the executive committeee and sent to the section members of the committee on May 13 with the request for their further comment and criticism. Responses to this communication were received from the following: Sections, Detroit-Ann Arbor, Erie, Fort Wayne, Indianapolis, Pittsfield, St. Louis and Toronto; individuals, L. C. Marburg, C. L. Clark, C. Francis Harding, P. M. Lincoln and Harold S. Osborne.

The tentative plan of procedure was very generally indorsed either entirely or with minor modifications. The executive committee believes that the reasons that more sections did not respond to a criticism of the tentative plan was that many of them found the plan satisfactory and thought it would go through automatically if they did not object.

A third meeting of the executive committee was held on June 16, and a report to be presented to a meeting of the full committee at the annual convention was prepared, the same being the original tentative plan as modified to meet the criticisms received.

At the Lake Placid convention the section delegates voted to merge their meeting with that of the development committee, and a meeting of the development committee and

section delegates was accordingly held on June 25, beginning at 1 p.m. at luncheon and continuing until after 6 o'clock. The president, the board of directors, several past-presidents and a few guests accepted the committee's invitation to sit with them and the entire report was very fully discussed. On the following morning the chairman presented the recommendations of the development committee to an open session of the convention, which adjourned until the evening of the same day and discussed the report at length. The recommendations which follow are the result of the foregoing proceedings. It was felt that unless the consensus of opinion among the membership at large were obtained a satisfactory plan would not be forthcoming. Your committee believes that such consensus of opinion has been obtained and recites the activities of the committee as its basis for that conclusion. There are also attached hereto, for convenient reference, the following exhibits:

I. Circular letter, dated Feb. 18, 1919, addressed to members of the development committee by the chairman and including the president's letter, dated Jan. 27, also list of committee members.

II. Original responses from the sections and from individual members.

III. The executive committee's report to the development committee, dated May 13.

IV. Original comments on the report of May 13 from sections and individual members.

V. The executive committee report of June 20 as submitted to the development committee, section delegates, board of directors and past-presidents at the annual convention, June 24.

VI. Tentative draft of constitution for local affiliation prepared by Messrs Hall and Robinson as a sub-committee and read to the development committee on June 24.

VII. Stenographic report of the convention sessions of the development committee and of the Institute.

VIII. The reports of the corresponding committee of the A. S. C. E., A. S. M. E. and A. I. M. and M. E. submitted to their respective boards.

IX. Original communications received since the annual convention with reference to the work of the committee.

## CONCERNING THE "PROCEEDINGS"

There is an almost unanimous view that the *Proceedings* do not seem sufficiently to interest the membership at large, and the suggestions of a remedy cover a wide range of possibilities. The value of the class of papers which heretofore have been published in the *Proceedings* as representing advances in the art and constituting a record of progress is appreciated, and it is insisted that the high standard of the Institute should be maintained, but it is believed that this view is not inconsistent with a recognition of the rights of 90 per cent or perhaps 95 per cent of the total membership who are concerned with the day-to-day engineering problems and with the personal side of engineering relationships. It is believed that if the *Proceedings* can be properly expanded that publication will serve better both to bind the present membership closer together and to furnish an added incentive for engineers not already members to join. The development committee has devoted a great deal of time to discussions of this matter, but feels that, with the recommendations of the various sections and the stenographic report of the Lake Placid meetings to be considered, further study should be given to this matter in order that the very best plan may be adopted. It therefore submits the following recommendations, to wit:

*Publication.*—That the publication committee be asked to consider and recommend to the board improvements in the present plan of publishing the *Proceedings* and the *Transactions* and of printing and distributing copies of Institute, section and branch papers.

That in dealing with these questions the publication committee consider:

A. Enlarging the editorial and executive publication staff for the purpose of expanding the *Proceedings* to contain additional live matter of interest and value to the membership as a whole without giving less importance to the principal activities of the Institute, *i.e.*, the promotion of the fundamental advance in the art and the encouragement of original investigation in the field of electricity.

B. Publishing all Institute papers and occasional papers of unusual broad general interest and value from sections or from other sources; publishing a set of abstracts of every paper presented to every section, so that each month there will be a complete record of this class of Institute activity.

C. Eliminating as far as may be feasible the duplication of expense now incurred by twice publishing the papers heretofore distributed (in both the *Proceedings* and the *Transactions*), but without depriving the membership of the *Transactions* in some form.

D. Publishing discussions in the *Proceedings*.

E. Endeavoring to increase the revenue-producing capacity of the *Proceedings* by expanding its advertising policy and if necessary changing its page dimensions.

F. Printing pamphlet copies of some or all section and perhaps branch papers and economizing on the cost of printing Institute and such section and branch papers by limiting their quantity and free distribution while making them available for the membership.

*Note.*—In considering the foregoing summarized recommendations the publication committee is asked to examine the stenographic report of the Lake Placid sessions of the development committee and of the Institute hereto attached.

## CLOSER PRRSONAL CONTACT

Another unanimous desire of the membership is for closer contact between the Institute officers, prominent engineers and the sections as a means of improving the morale of our organization, stimulating section activities and interesting the membership at large, particularly the younger members, in Institute work. With the large number of sections and branches now in existence and the probability that this number will increase, it seems obvious that if the present Institute officers were to comply with this demand they would have time for nothing else and even then the demand would not be satisfied. An obvious alternative therefore is to have more officers and let them be chosen from different parts of the country. If this be done and these officers are to be really participants in the Institute management and not simply visiting functionaries, means must be provided to insure their attendance at Institute and board meetings. It is believed that these objects can be accomplished by decreasing the number of Institute meetings, thereby reducing the demand on the time of its officers; by holding them in different parts of the country, thus making it easier for those residing at points remote from headquarters to attend, and by paying the expenses of board members when in attendance. If the Institute meetings be not held in New York, it almost naturally follows that the New York members, constituting a very large and important percentage, should organize a section so that their present opportunities may be expanded instead of abridged.

In order to accomplish the results described the committee makes the following recommendations, namely:

*Organizations.*—(a) That a New York section be organized and conducted on the same lines as existing sections elsewhere.

(b) That the present practice of holding some of the Institute and directors' meetings in different localities, where local sections are established, be extended, instead of holding nearly all of these meetings in New York as at present. It may be desirable to reduce the frequency of Institute and directors' meetings and hold them every two months, or perhaps even less frequently, instead of every month as now.

(c) That the country be divided into geographical divisions corresponding in number to the number of Institute vice-presidents. If more than six divisions should be thought desirable, they should be established and the number of vice-presidents increased to correspond. In order to allow for the future shifting of membership density and at the same time to escape the necessity of cumbersome constitutional amendments, the number and delimitation of geographical divisions should be specified in the bylaws instead of the constitution to provide for ready amendment by the board of directors.

(d) That one vice-president be selected from each geographical division, the president and managers to be elected from the membership at large as at present.

(e) That the Institute should pay the traveling and living expenses of the officers and board members when attending Institute meetings.

(f) That it be the duty of each vice-president to visit each section in his own division at least once a year, the Institute to pay his traveling and living expenses for such visits. Of course it would also be desirable if the vice-presidents could exchange visits.

(g) That the vice-presidents' term of office be lengthened from one year to two years and the constitutional inhibition against the election of a vice-president as manager be removed. Provide against too extended tenure of office by a constitutional provision that except in the case of a manager or a vice-president who may be elected president no member may continuously hold office longer than six years.

*Activities.*—(a) That committee work be decentralized as far as it may be found feasible and desirable by substituting section committees for Institute committees. Appoint a general committee to study this question and make recommendations.

(b) That more high-grade papers of general engineering interest be presented.

(c) That a committee be created in each section charged with the duty of assigning to the younger members specific participation in designated meetings by the preparation of papers, discussion or otherwise. It is hoped by this means and by the appointment of a reasonable number of the younger men to the larger committee membership caused by decentralization that the interest of the younger men will be stimulated and their loyalty increased.

### ENGINEERS IN PUBLIC AFFAIRS

There is a universal recognition of the fact that engineers do not participate as actively or as prominently in public affairs as they should and that both the public welfare and their own individual advancement would be promoted if this condition could be rectified. There are two general reasons believed to be responsible for the existing condition, one a lack of any general organization of engineers which would facilitate their coöperation, and, second, too great technical specialization in the engineering curricula of our technical schools and colleges, which tends to narrow the vision of the engineering student and starts him on his career with an exaggerated idea of the importance of specialization and an insufficient appreciation of the part he must play in public affairs.

The first of these reasons was very generally brought up in one form or another by the sections, and although it is recognized that a corrective can be applied by our Institute only in coöperation with other engineering bodies, it was felt that we could properly take a constructive step by adopting a skeleton plan for coöperation and then appoint conferees who could discuss the matter with similar conferees from other societies and endeavor to agree to definite recommendations to their respective governing bodies. With this object in mind the committee respectfully recommends:

*Local Federation.*—(a) That a comprehensive but flexible uniform outline for the federation of local engineering bodies be prepared, taking advantage of the experience already gained by existing affiliations.

(b) That we use our endeavors to have the other national societies establish and support local sections along lines similar to ours, but do not confine local federations to such branches, rather planning to include all the worthy engineering bodies.

(c) That wherever such federations can be organized there be established under an appropriate name a federated local council of engineers to be made up of a properly apportioned number of representatives from the different locals.

*National Council.*—(a) That there be established a direct touch between each local federated council and a National Engineering Council composed of delegates from as many national engineering societies as are willing and worthy to participate.

(b) That through the medium of the national and the local federated councils there be perfected a working arrangement for engineering coöperation in all public affairs where such is desirable.

*Engineering Congress.*—That there be inaugurated the custom of periodically holding an engineering congress, the delegates to which should be selected from all parts of the country under a plan to be developed for suitable representation, this congress to consider and take action on such matters of general interest to engineers and to the public as may merit its attention and as have been previously advertised for a sufficient length of time to permit locals everywhere to give them consideration and when possible to send instructed delegates.

### CURRICULA OF TECHNICAL SCHOOLS

The second reason — namely, a possible modification of the engineering curricula of our technical schools and colleges—while perhaps of underlying and fundamental importance, not only did not have the general consideration of many of the sections in their local deliberations but was nearly crowded off the Lake Placid program by the press of other matters. It was, however, the unanimous view of the members attending the session at Lake Placid that this matter should receive early and thorough consideration by the Institute, and the following preamble and resolution was there presented and adopted:

As the individual engineer cannot look for greater public recognition or individual advancement than his training and fitness warrant, and in the belief that the bigger development of the profession consists in broader social and public service by publicly minded engineers; recognizing that on the one hand young engineers are employed for too long a period at work which does not stress their capabilities and, on the other, that the demands of industry for ever-increasing numbers of technicians must be supplied, and having in mind the excellent precedents established by the medical and legal professions, this committee would welcome the establishment at the earliest date practicable of a normal six years' collegiate course in engineering, two years of which at the least should be devoted to training in the humane arts and sciences, including, for example political science, economics, history and general letters, the last four years being devoted to sound training in the sciences and in only the fundamentals of diversified engineering.

With or prior to such a development we would indorse a program for the marked extension of vocational training in the industrial centers in order that the needs of industry may be met.

To the accomplishment of these ends this committee requests the appointment of representatives to serve on a joint committee of engineering organizations to promote such a national educational program as shall provide for the future necessities of the engineering profession consistent with the needs of society.

Closely allied to the consideration of curricula is our policy toward the student branches, and the chairman of the Institute committee on branches attended the Lake Placid session and was good enough to bring this question forcibly to the attention of the committee; whereupon a motion was adopted that a committee of the Institute be appointed to confer with the branch representatives and recommend what, if any, changes should be made in relationship of the branches to the Institute and to development, in order that this very important part of Institute activities should have full consideration and be given the attention which it merits.

While the board's resolution did not specifically instruct the development committee to confer with similar committees from the other national engineering societies, the chairman was informally advised by the president that where such conferences could expedite and help to crystallize the viewpoint of the several organizations concerned without committing the Institute to any line of action they would be desirable. Responding, therefore, to a suggestion from the development committee of the American Institute of Mining and Metallurgical Engineers and to an invitation from a similar committee from the American Society of Mechanical Engineers, Messrs. Scott, Robinson and the chairman have conferred with representatives from the development committees of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers, and discussions are in progress relative to joint action by the several societies represented. These discussions have not as yet proceeded far enough to indicate what if any recommendations the several governing bodies may be agreed upon, but it is gratifying to be able to report progress and state that the spirit of cooperation manifested by the other conferees is a good omen.

All of which is respectfully submitted,

COMMITTEE ON DEVELOPMENT,
CALVERT TOWNLEY, Chairman.

## *Commission Rulings*

Important decisions of various state bodies involving or affecting electric light and power utilities.

**Sustaining Rates Based on Higher Costs.**—A decision of the Pennsylvania Public Service Commission, dismissing a complaint against proposed increases in rates of the Boyertown Electric Company, says: "The former rates were apparently satisfactory, and predicated upon that fact the net income derived under them could not be maintained to have been unreasonable or excessive. The companies' figures for 1918 show a net return for that year considerably lower than in 1915 and in 1917. It therefore would appear to be reasonable to presume, in the absence of definite and conclusive evidence to the contrary, that the respondents should not be restrained, under existing operating conditions, from applying rates that are earning a lower net revenue than the companies obtained under the old tariff. From the position taken by respondent in defending its action it would appear that the tariff under attack was filed to provide an emergency rate to continue in effect at least during the period of the high prices recently prevailing. Counsel for respondent so maintained in his brief. This in substance is implying that when the cost of labor and materials resumes a normal and stabilized level there will be a revision of rates filed under a new tariff. The commission accordingly finds under circumstances now controlling that the complaint should be dismissed, with the privilege accorded to complainants to file a new complaint, if they so desire, should the present rate be continued when expenses for operation and plant maintenance have fallen sufficiently to indicate that the net earnings of the respondent may show a material increase per annum."

**Purchased Energy.**—A recent decision of the Pennsylvania Public Service Commission in reference to the Boyertown Electric Company touches incidentally on its purchase of energy from the Metropolitan Edison Company of Reading. It says: "The respondent supplies electric energy for light and power purposes to 716 consumers in Boyertown, and to forty-two outside of that municipality who reside in several of the outlying towns and intervening territory. It also delivers energy at the switchboards of a few small boroughs a mile or two distant, for local consumption. It owns a small steam generating plant which is used now only as a reserve equipment in case of an interruption or suspension in the service. Its general supply of energy is obtained from the Metropolitan Edison Company of Reading over two lines or routes at convenient points of connection with its distribution plant. The two lines of transmission are so adjusted by means of switch connections which separate units of the generating system that continuity of service is insured over one or the other circuit. There were no estimates submitted to show what it would cost respondent to generate its own current. It was, however, contended on its behalf that, because of the larger generating units in the Metropolitan system, it is cheaper to purchase energy from the latter than to produce its own power. While this is not conclusive as to that fact, yet it is safe to assume under all the circumstances present that the connection of the respondent is correct, and that it is in this instance at least a proper operating economy to purchase its energy from the Metropolitan company."

**Losses in Competitive Warfare.**—In a decision handed down by the California Railroad Commission the sum of $42,041 is fixed upon as the just compensation to be paid by the city of Redding to the Northern California Power Company for the company's electricity distributing system in Redding. This is held to be a fair value for "physical properties, plus overheads, including franchise value and going concern." The company had claimed a value of $226,301.01. Claims for development costs presented by the company were not allowed, and only the actual costs of extensions made necessary by the separation of the lighting section from the other utilities operated by the Northern company in Redding were given place in the commission's consideration of the company's demand for severance damages. No amount was fixed for severance damages, the commission holding that they probably could be eliminated by means of a contract between the city and the company providing for adequate arrangements by which the company could maintain its telephone and power circuits. The commission rejected as unsound the power company's theory for measuring "going concern value," giving particular denial to the company's claim for certain losses "sustained during the course of developing the present business," holding that it had not been shown that the losses were actually incurred within a reasonable development period. "Losses," says the commission, "incurred by a company in unrestrained and competitive warfare before the period of regulation of rates by public authority cannot by the wildest stretch of imagination be included within any legitimate and reasonable development's costs." A feature of the decision, as a document important in the work of arriving at "just valuation," is the determination of the commission in valuation proceedings "to show reproduction cost based on prices for material and labor during a fair construction period immediately preceding the date of the application, with a deduction from that estimate of such sum as will represent the item of depreciation."

## *Recent Court Decisions*

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Authority to Increase Rates.**—In a unanimous decision recently handed down by the Court of Appeals of New York, two questions were dealt with—whether the Legislature had power to raise the rate of fare and whether the Legislature ceded this authority to the Public Service Commission when it passed the Public Service Commission law. The opinion holds that power to change the rate of fare was vested in the Legislature and that the Legislature in passing the Public Service Commission act delegated this power to the commission.

**Towers Construed as "Poles."**—The Court of Appeals of Texas (212 S. W. 222) has held, in the case of Stemmous vs. Dallas Power & Light Company, that in proceeding to condemn land for the use of electric power lines the provision of the law that lines shall be constructed upon suitable "poles" means either wood or metal poles, and in view of the land being subject to overflow, and because of the necessary carrying of numerous wires and the distance between poles, the statute must be construed to include towers as well as "poles," no strict interpretation of the latter word being obligatory.

**Flooding of Lands Below Dam.**—In the District Court of the United States for the northern division of the middle district of Alabama at Montgomery, Ala., July 15, Judge Clayton handed down the opinion that T. T. Charles and 130 others who sued the power company for damages because their lands and crops were overflowed in August, 1917, alleging that the damages were caused by the negligent operation by the power company of its dam on the Tallapoosa River, had not proved the allegations of their complaints and could not recover. The judge was of the opinion that the floods were occasioned by exceptionally heavy rains and not by the power company's negligence. The opinion goes exhaustively into the law and facts of the case. Judge Clayton concluded his opinion in part as follows: "To entitle Charles and others to a recovery, it must, of course, be shown that the power company was guilty of negligence which proximately caused the injuries complained of. The burden of showing that the power company was guilty of actionable negligence in erecting or maintaining flashboards and that such negligence approximately caused the injury, that is, the flooding of the plaintiffs' lands, and the consequent damage complained of, has not been discharged by Charles and others."

**Government Seeks Wireless Monopoly.**—Secretary Daniels in a message to Congress asks that legislation be enacted making ship-to-shore, transocean and international radio communication from the United States a government monopoly. A request was also made for a technical committee to be appointed to study radio conditions in the United States.

**Trade Conference Plan.**—The Chamber of Commerce of the United States, in coöperation with other governmental agencies, will hold an international trade conference in Atlantic City during the week of Oct. 5. The government will entertain delegates from Great Britain, France, Italy and Belgium to whom the chamber has already extended invitations.

**N. E. L. A. to Issue Folder.**—The publications committee of the Commercial Section of the National Electric Light Association expects to publish shortly a large edition of a four-color folder entitled "Electrical Gifts" which is intended for distribution by companies dealing in appliances to the retail trade. The folders, which contain illustrations, are to bear dealers' names as imprints.

**Ample Reserve of Water Stored in Montana.**—Reports that shortage of water in Montana would interfere with the supply of electrical energy in that state are denied. Frank Kerr, general manager of the Montana Power Company, is reported as saying that there is sufficient water stored to provide energy for all commercial needs, including the requirements of the electrified division of the Chicago, Milwaukee & St. Paul Railway, which is served by the company.

**Waterfalls Not Always Water Powers.**—In the *Empire News*, published by the Empire Gas & Electric Company, Geneva, N. Y., L. C. Reynolds says in part, in dealing with the subject of "Waterfalls Not Always Water Powers": "The future tendency for power from all sources is to increase in cost, and water powers which at present are not profitable to develop will gradually become so. There is no power shortage, or the prospect of being any, and contrary to the general belief the depletion of the world's coal supply to date is but a small nick out of the immense deposits still untouched. Long before such deposits are exhausted power from some undeveloped source, possibly direct from the sun, will be available. The old saying that you can lead a horse to water but you cannot make him drink applies to a water power. You can place wheels at a waterfall, but you cannot make them turn without water. Some writers, sentimentally inclined, have compared our water powers to powerful white horses running wild as contrasted with the black horse symbolical of the power from coal; but do not provide an expensive harness for this white horse, which will periodically shrink in stature until the harness falls off from him, unless you can afford to provide means of keeping him in the harness or maintain a black horse ready to take his place when he lies down. All water powers are waterfalls, but all waterfalls are not possible water powers."

## *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Power Company to Pension Employees.**—Authorization of its pension plan, whereby male workers of sixty and women workers of fifty-five years will be entitled to pension benefits, was sought by the Southern California Edison Company before the California Railroad Commission recently.

**Holyoke Power Investigation.**—Samuel M. Green, consulting engineer, Springfield, Mass., has been retained to investigate and report to the city of Holyoke upon the desirability of purchasing hydroelectric energy from the Turners Falls Power & Electric Company in comparison with other means of expanding the electrical production facilities of the city.

**Licensing Engineers in Japan.**—All the chief engineers of electrical power, light and railway companies in Japan need to have government licenses except the graduates of technical colleges and schools of officially recognized standing. The license is classified into six grades according to the voltage used by the enterprise. The examination for licenses is held once every year.

**Commission Passes on Cut Prices.**—In the case of J. R. Blackhall and Thomas F. Ryan versus the Public Service Company of Northern Illinois the Public Utilities Commission of Illinois heard a complaint relating to practices of the defendant company in connection with the sale of merchandise and jobbing work which affected the interests of the local contractors in Chicago Heights, Ill. In this case the company announced that if there had been any discrimination in the prices at which merchandise had been sold the practice would be corrected immediately. The commission made the following statement in respect to house wiring, for which the complainants claim the defendant company underbid local contractors: "This is work performed by the company in connection with the acquisition of new business. This commission will expect that not only the defendant company but all public utilities will make all reasonable efforts to secure new business to the end that the use of public utilities' commodities will be increased, thus decreasing the cost of production, which must necessarily benefit the consumers. The commission is without jurisdiction in the matter, and it is therefore dismissed."

**Oxford, Ohio, Sells Plant.**—After experimenting in municipal ownership for thirty years, the village of Oxford, Ohio, has disposed of its electric light plant, long operated at a loss. The Ohio Gas & Electric Company, which has purchased the system, will erect a transmission line from Middletown.

**Technical Men Demand Higher Salaries.**—Technical men in the employ of the city of New York have asked for an increase of $500 a year. This increase will affect 2500 men in the city departments and 660 workers employed by the Transit Construction Commission. Junior engineers, engineering assistants, chemists, architects, inspectors, etc., engaged in engineering work are included among the workers requesting the increase.

**Status of Electric Supply in Japan.**—According to the official publication of the Department of Communications, the status of the electrical industry in Japan at the end of April, 1919, was as follows: Number of enterprises, 624 central stations, 41 electric railways, 49 central stations and railways, making total of 714, the increase over last year being 27. Total capital for central stations, 431,954,059 yen ($215,000,000); for railways, 48,779,470 yen ($25,000,000); for central stations and railways, 346,814,497 yen ($173,000,000), making total of 822,548,026 yen ($411,000,000), the increase over last year being 62,233,856 yen ($31,000,000).

**Value of "Movies" in Electrical Propaganda.**—In a statement to the ELECTRICAL WORLD regarding the motion-picture films made by the Society for Electrical Development, Inc., New York City, to spread the gospel of "doing it electrically," Miss Grace T. Hadley of the society's editorial department said: "If, as a well-known editor once remarked, 'One good photograph is worth a million words,' then a good little 'movie' must be worth several million words, picturing as it does so graphically even in 125 feet the difference between the old and the new ways of doing household work, the washing, ironing and other drudgery lifted to a high new standard by the use of electrical appliances."

**Automobiles at the New York Electric Show.**—The New York Electrical Exposition, which is to be held during the ten days beginning Sept. 24 at the Grand Central Palace, will have among its exhibits several displays by the leading manufacturers of electric automobiles. In the commercial car section will be seen different sizes and types of trucks built by the Ward Motor Vehicle Company, the Commercial Truck Company of America and the Walker Electric Vehicle Company. Passenger cars will be exhibited by the Baker R. & L. New York Corporation and by the Metropolitan Detroit Electric Automobile Company. Storage-battery manufacturers will be represented by the Electric Storage Battery Company and the Philadelphia Storage Battery Company. The Bennage company will show a new type of electrically heated vulcanizer of special interest to automobilists.

**W. H. P. Hill,** for the past two years sales manager of the Idaho Power Company at Boise, has recently resigned to accept the position of secretary of the Boise Commercial Club.

**C. B. Booth,** for a number of years commercial manager and claim agent of the Vicksburg (Miss.) Light & Traction Company, severed his connection with that company on Aug. 1 to become the business manager of a Mississippi electrical concern.

**I. M. Stover,** for the past two and one-half years manager of the Baton Rouge (La.) Electric Company, a Stone & Webster property, has been transferred to the general office of the latter company in Boston, Mass. Mr. Stover was formerly manager of the Key West (Fla.) Electric Company.

**F. C. Chamberlain,** who has been appointed general manager of the Richland Public Service Company, Mansfield, Ohio, succeeding R. E. Burger, has been with the H. L. Doherty organization a little over six years. Before that time he was associated with the American Gas & Electric Company at Wheeling, W. Va. For about four years previous he had been in the New York office. He was graduated from the University of Wisconsin in 1904.

**Davis M. De Bard,** head of the power sales department of the Edison Electric Illuminating Company of Brockton, Mass., has left the central-station field to become head of the statistical department of the "Walk-Over" Shoe Company, with headquarters at Brockton. Mr. De Bard has been connected with the Brockton Edison company for the last nine years and is widely known in the New England electrical field. He is a past-chairman of the New England Association of Central Station Power Engineers and has been active in local National Electric Light Association circles. Mr. De Bard was a pioneer in the application of electric heating to the shoemaking industry, and conducted tests to show the economy of applying central-station service in this field.

**Arthur B. Reynders,** former director of production of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has recently been made works manager of its East Springfield (Mass.) plant. Mr. Reynders began work with the Westinghouse company in 1899 as draftsman. In 1902 he was made an engineer on circuit breakers, switches and relays. After serving in that capacity for two years he became acting assistant chief draftsman. In February, 1906, he was made general engineer on insulation work for the Westinghouse company, and three and one-half years later was appointed assistant to manager of engineering. In March, 1912, he was promoted to have direction of production, in which capacity he served until his latest appointment. A. E. Kaiser, who has been assistant to the director of production at East Pittsburgh since 1912, has been appointed director of production to fill the vacancy made by Mr. Reynders' new appointment.

# *Men of the Industry*

Changes in Personnel and Position— Biographical Notes

**Charles S. Ruffner** of St. Louis has been elected a director and vice-president of the North American Company with headquarters in New York City. The North American Company controls the Union Electric Light & Power Company, St. Louis, of which Mr. Ruffner has been vice-president and general manager for about three years. He relinquished the local management of the St. Louis company on taking up the broader work for the parent company.

C. S. RUFFNER

He retains the offices, however, of vice-president of the Union Electric Light & Power Company and the St. Louis County Gas Company and president of the American Light & Power Company, St. Charles, Mo., the Commercial Telephone Company and the Arrow Engineering Company, all of which are North American subsidiaries. Mr. Ruffner was born in Chicago in 1880. In 1900 he was graduated from the University of Missouri with the degree of bachelor of science in electrical engineering. He started in engineering with the Telluride Power Company and Central Colorado Power Company in large power transmission work, and since 1911 has been an officer of subsidiaries of the North American Company. To Mr. Ruffner is due the credit for the design and erection of the 60,000-kw. substation at the St. Louis end of the 110,000-volt transmission line from the Keokuk hydroelectric development. He is a manager and fellow of the American Institute of Electrical Engineers and a member of the American Electrochemical Society. He was also appointed associate member of the Naval Consulting Board in 1916. While Mr. Ruffner has taken up his residence in New York, he expects to spend a considerable portion of his time in the Middle West.

**Albert E. Legge,** who has been chief clerk of the purchasing department of the Commonwealth Edison Company, Chicago, has resigned to become purchasing agent for the Public Service Company of Northern Illinois. His new position gives him charge of purchasing and storing all materials used by the company. Mr. Legge had been employed by the Commonwealth Edison Company for a period of twenty-four years.

**B. F. Tucker** has resigned as manager of operations for the Central Illinois Public Service Company at Mattoon, Ill., to become manager of a 1225-acre farm south of Peoria, Ill. Mr. Tucker was one of the owners of the electric lighting plant at Virden, Ill., until it was sold to the Central Illinois Public Service Company. He then entered the service of that company at Taylorville, Ill., taking the position of district superintendent. Later he was transferred to Mattoon as assistant general superintendent and in February, 1915, was made general superintendent. In January, 1919 he became manager of operations.

## Obituary

**James W. Poole,** head of the electrical supply house of James W. Poole, Inc., Boston, Mass., died on Aug. 7 after a period of ill health lasting about three years. Mr. Poole was born in London, England, about sixty-six years ago. He came to America at the age of sixteen and spent nearly his entire business life in Boston or vicinity. He was well known in the wholesale electrical supply field, where his principal interests lay. For many years he was active in yachting circles.

**Patrick Kennedy,** a pioneer inventor in the development of electric lighting for railroads, died July 21, at his home in Brooklyn, N. Y. Mr. Kennedy was born in Ireland, and in 1878, with Charles J. Diss, formed the machinist firm of Kennedy & Diss, at 112 Front Street, Brooklyn. Mr. Diss retired in 1894 and the business was continued as the Kennedy Machine Works. Mr. Kennedy was chief engineer of the Consolidated Railway Electric Light & Equipment Company up to 1914, when he retired from business.

**Joseph Williams,** one of the oldest employees and officials of the New York Edison Company, died July 26 in Santa Monica, Cal., where he had gone to recover from a recent illness. Mr. Williams was associated with the old Edison Illuminating Company from 1890 as assistant treasurer and was elected to the same position when the New York Edison Company was organized in 1901. Subsequently he was elected treasurer, which position he held until his death. Mr. Williams was born in New York City sixty-one years ago.

# TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

## FIBER-CONDUIT MARKET SHOWS RETURNING LIFE

### Power-House and Line Developments Are Light at Present but Increasing—Prices Are Slightly Easier

The market for fiber conduit is gradually coming back into its own, and it is expected that by the first of the year there will be a pretty fair business under way. In the fields where it is generally used—power-house building and additions, underground feeder-line extensions and ducts for communication and signal wires—there has been little business offered in the past two years, but of late the market has begun to open up.

This resumption of trade is more noticeable in the larger cities of the Middle West, where recent orders placed show returning activity. In that section of the country several of the larger cities have recently been in the market with orders running up into several hundred thousand feet. One thing to be borne in mind, however, is the fact that at this time much conduit is underground, through which lines are being pulled. So that recent large orders for wire and cable do not necessarily mean additional buying of conduit.

The foreign field is also buying fiber conduit, according to recent shipments to Europe, and more orders would be booked to South American countries were the boat bottoms available. However, the export trade is liable to suffer because of the excessive freight charges. Where freight is charged on volume rather than weight this product is greatly handicapped, for these charges have been twice the value of the product.

There has been found a recent easing off in price of about 8 per cent, but this has not been traced to any easier costs of labor or materials. Factory stocks of raw materials are satisfactory and deliveries of the conduit can be made almost immediately.

## JUNE ELECTRICAL EXPORTS MAKE RECORD OF $10,990,817

### First Half Year's Total Is $48,582,439—Month Beats All Previous Ones by More than Three Million Dollars

All records of exports of electrical merchandise were broken when the month of June showed a total of $10,990,817. This is more than $3,000,000 greater than any previous month on record. Several records were chalked up for individual items, most prominent of which were insulated wire, motors, generators and switching apparatus. The latter more than doubled the exports of any previous month, while motors increased nearly 30 per cent over the next highest month, last October, and generators came up almost 50 per cent over their next highest month, last April. Insulated wire beat its March record by 40 per cent. Batteries, interior wiring, heating and cooking apparatus, rheostats and miscellaneous electrical material showed substantial gains.

Canada, Argentina, France and Japan were the most prominent importers. The largest exports of generators went to France, Japan and Spain; of insulated wire to Norway, Argentina and Netherlands; of motors to British India, France, Australia and Japan; of switches to Brazil and Argentina, and of miscellaneous material to Canada, Japan and England.

Totals for the first half year came to $48,582,439, which gives an annual rate of over $97,000,000. Totals of twelve months through June show $80,712,110, against $54,546,961 a year ago.

Figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce:

| | June | | Twelve Months Ended | |
|---|---|---|---|---|
| | 1918 | 1919 | June, 1918 | June, 1919 |
| Batteries | $272,316 | $787,748 | $3,351,838 | $4,800,668 |
| Carbons | 117,995 | 173,582 | 1,525,128 | 1,672,106 |
| Dynamos or generators | 133,549 | 760,546 | 2,688,169 | 4,269,103 |
| Fans | 164,486 | 130,817 | 818,338 | 1,297,017 |
| Heating and cooking appliances | 49,185 | 192,551 | 533,988 | 1,222,886 |
| Insulated wire and cable | 340,138 | 1,420,699 | 5,730,766 | 8,683,304 |
| Interior wiring supplies, including fixtures | 138,805 | 280,631 | 1,532,309 | 1,926,177 |
| Arc lamps | 90 | 173 | 13,308 | 14,555 |
| Carbon-filament lamps | 3,985 | 5,276 | 144,761 | 166,294 |
| Metal-filament lamps | 475,768 | 530,085 | 3,182,516 | 4,465,075 |
| Magnetos, spark plugs, etc | 167,710 | 219,826 | 3,167,325 | 3,020,610 |
| Meters and measuring instruments | 208,294 | 319,336 | 1,592,195 | 2,618,40 |
| Motors | 521,442 | 1,562,521 | 6,598,664 | 10,677,354 |
| Rheostats and controllers | 24,170 | 65,384 | 212,059 | 434,413 |
| Switches and accessories | 188,408 | 593,975 | 2,229,023 | 2,663,327 |
| Telegraph apparatus, including wireless | 11,659 | 92,220 | 294,297 | 765,011 |
| Telephones | 274,809 | 377,395 | 2,566,929 | 3,135,851 |
| Transformers | 464,195 | 438,483 | 2,313,968 | 4,423,007 |
| All others | 1,462,515 | 3,039,569 | 16,021,380 | 24,457,147 |
| Total | $5,019,519 | $10,990,817 | $54,546,961 | $80,712,310 |

## IMPROVEMENT SHOWN IN STEAM-TURBINE SALES

### Factory of One Large Company Working to Capacity On Units Up to 10,000 Kw. Rating—Deliveries Six to Ten Months

With the resumption of peace conditions there has been a return of steam-turbine business for central stations and industrial plants which, according to one of the more prominent manufacturers, shows a healthy growth throughout the country. The Western, Middle Western and Southern sections, however, give evidence of quicker return to normal commercial conditions than the rest of the country.

Steam turbines in sizes up through say 10,000 kw. are running in better volume than those of larger size, and orders are coming through in a satisfactory manner. The volume of ordering for units up through 10,000 kw. is such that a comfortable capacity is now being maintained in the shops, and the general growth of sales is continuing in a normal manner.

During the war many potential customers for these nominally smaller sizes were kept out of the market because they could not get priorities to enable them to increase their power-generating capacity. These orders are now being handled by the manufacturers. Customers who needed units of larger sizes have been able to have their wants filled, and manufacturers are about cleaned up on these back orders.

Turbine prices are holding steady, and there is no evidence that there will be any downward revision. The industrials and central stations have come to realize this condition, and where the smaller-sized units are required, as well as where their need can be anticipated in the near future, orders are being placed in good volume. Shipments for these sizes are in the neighborhood of six to eight months,

and this is one determining factor in the decision to order.

As regards the larger sizes, it seems to take longer for customers to come to the realization that there is no downward tendency of prices and to get under way in their orders for turbines. Shipments are about ten months; so it would appear that in order to get into operation by next summer it is about time to consider the placing of orders. On these larger sizes over 10,000 kw. the factories are not working to capacity. There is, however, much proposition work on the boards. Foreign orders are being received in pretty fair shape.

A report from another prominent turbine manufacturing company is to the effect that its business in that line is less than before the war but that present prospects point to a large business in the near future.

## METAL MARKET SITUATION

### Large Copper Producers Holding While Seconds Offer at Lower Price—Market Quiet

Copper may be purchased for August delivery for as low as 21.50 cents delivered. This represents the price to which independents and second hands will go in order to create a buying market and move some of their stock. Their price for shipments in October is only ¾ cent higher. The producers, on the other hand, have no intention of trying to force a market on unwilling buyers, who, they figure, have all they can use for some time. It would mean merely a cutting of prices to the point where these consumers would be willing to get aboard and lay in larger stocks than necessary. The producers feel that the buying will resume in the fall, when prices will be no lower. They are holding unchanged at 23.50 to 24 cents.

Production is in some instances increasing. On the other hand, imports of copper are decreasing. Exports have not been large in August. The month of June showed exports of insulated wire and cable to the value of $1,420,000. This is the largest export of covered wire on record, and of this Norway was the largest importer, with Argentina and the Netherlands next in order.

Copper and brass sheet, tube and bar products are holding steady in price. The market will not be materially helped by the government's announcement to sell its surplus brass—96,000 tons—on sealed tenders. The scrap coppers have declined in price nearly 2 cents, and sales have been restricted. The brasses are off ½ cent a pound.

Lead is being sold by outside interests at 5.60 cents a pound in New York, while the American Smelting & Refining Company is holding for 6 cents. Much is being sold at the lower price, particularly white lead.

Zinc is down slightly to 7.65 cents, but there was more activity at the end of last week. Copper and lead are causing a reaction to zinc.

### NEW YORK METAL MARKET PRICES

| | Aug. 6 | Aug. 12 |
|---|---|---|
| Copper: | £ s d | £ s d |
| London, standard spot | 96 0 0 | 92 5 0 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | 22.50 to 23.00 | 22.25 to 22.75 |
| Electrolytic | 22.00 | 21.50 |
| Casting | 21.62½ | 21.00 |
| Wire base | 26.00 | 26.00 |
| Lead, trust price | 6.00 | 6.00 |
| Antimony | 9.12½ | 9.00 |
| Nickel, ingot | 40.00 | 40.00 |
| Sheet zinc, f. o. b. smelter | 10.50 | 10.50 |
| Spelter, spot | 7.72½ | 7.65 |
| Tin | 70.00 | 70.00 |
| Aluminum, 98 to 99 per cent | 30.50 to 32.00 | 31.00 to 33.00 |

### OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 20.00 to 20.50 | 18.00 to 19.00 |
| Brass, heavy | 10.50 to 11.00 | 10.00 to 10.50 |
| Brass, light | 9.50 to 9.75 | 9.00 to 9.50 |
| Lead, heavy | 5.12½ to 5.50 | 5.12½ to 5.25 |
| Zinc, old scrap | 5.25 to 5.50 | 5.00 to 5.25 |

# THE WEEK
## IN TRADE

THE jobbing and retail business in the East and Middle West seems to be holding up in slightly better shape than in the Far West. Freight and labor conditions may have something to do with this. Some Western stocks are getting low, and shipments are growing worse through railway shop strikes. The attempt is being made to accumulate larger stocks in anticipation of a general slowing up in freight with the coming grain movement this fall.

Rigid conduit, flexible metallic conductor, weatherproof wire, schedule material and appliances are moving well. Collections in general are reported in good shape. Building is on the increase in all localities and is shown above the average of the last five years for a like period. Local strikes are affecting building operations, however, in several cities. The railway shopmen's strike is not settled, and embargoes are being placed on freight in some localities.

## NEW YORK

Reports from jobbers indicate that business in general is good. Rigid conduit and its fittings and rubber-covered wire are moving in better volume, and a general response is being felt all along the line. Motors, transformers, lightning arresters and meters are carrying a good trade.

Building in the district continues to advance. The contract has been given for the thirty-third factory to be erected in the borough of Queens in New York City since Jan. 1. July contracts let in the New York, Philadelphia, Washington and Pittsburgh sections total $175,000,000, running from 74 to 100 per cent, depending on the section, over those for June.

Labor is still very unsettled. Railroad shopmen out on strike are tying up freight and passenger traffic in some places, while other places have not responded to the call. Conditions are better in and around the Rome (N. Y.) mills. The Brooklyn Rapid Transit employees have returned to work, but with the labor agitators still in New York City, there is already talk of possible trouble on Manhattan lines.

**INSULATION.**—Cotton webbing has been advanced 10 per cent and cotton sleeving 14 per cent in price. Varnished silk insulation and silk-covered wire are also up 10 per cent.

**TAPE.**—Friction tape has been marked up 2 cents a pound.

**MOTORS.**—Sales are getting heavier on standard industrial motors under 50 hp. Alternating-current stocks in New York are in general getting smaller, while direct-current stocks are lacking in some sizes and building up in others.

**TRANSFORMERS.**—Local stocks are building up in better shape than they were a few weeks ago. The demand for distribution sizes is large.

**LIGHTNING ARRESTERS.**—Better sales are reported in pole-type and station-type arresters.

**INSULATORS.**—High-tension porcelain insulators have advanced in price 10 per cent. Recent orders have been large and shipments have lengthened to a considerable extent.

**RIGID CONDUIT.**—Better movement of conduit and iron fittings has been reported from all sides. Factory shipments of iron conduit have been put ahead sixty days.

**FLEXIBLE ARMORED CONDUCTOR.**—Sales continue large, but factory shipments are filling a larger percentage of orders than heretofore.

**WIRE.**—Nine rubber-covered wire bases are now quoted on 30 cents and three are on 28 cents. Bare is holding,

but weatherproof has gone up 1 cent to 28 and 30 cents base.

**LAMPS.**—The new "White Mazda" has begun to find its way to consumers and, although dealers' supplies are not yet large, the lamps are meeting with much favor.

**DRY BATTERIES.**—Sales of dry batteries are in good volume, with no surplus stocks in manufacturers' hands, it is reported.

**BELLS AND BUZZERS.**—There is better buying of bells and buzzers, although it is still below normal. There have been no recent price changes, but it is anticipated that the reduction of a few months ago will be covered by an increase at any time.

**STREET LIGHTING.**—Buying in the New York district is still quiet, but is slightly better than earlier in the summer and is expected to increase soon. Prices have been holding steadily, it is reported, since the first of the year, but one manufacturer feels that an advance must be made in some lines of street-lighting fixtures. One manufacturer has just increased prices on iron castings 7 to 15 per cent. Municipalities and central stations are apparently preparing to go ahead with street lighting, according to the number of inquiries in manufacturers' hands. Many of these seem about ready to drop.

## CHICAGO

The building tie-up in Chicago has been made complete. The contractors' employers' association has extended the lockout to all labor, and no building material can be purchased from dealers without the association's permit, which is given only to cover material for emergency repair work. Chicago electrical contractors are depending entirely on work in old buildings, and there is not very much of it contracted for ahead. Plans have been made for the erection of a four-million-dollar cold-storage warehouse in Chicago. A million-dollar factory and warehouse is also to be erected for the Cook County Paper Stock Company. At Elyria, Ohio, the Willys-Overland Company will proceed with the building of a factory where about 9000 people will be employed. The Timken Roller Bearing Company of Canton, Ohio, announces that within the next ninety days it will build a branch factory at Columbus, Ohio, where from 600 to 700 men will be employed. Permits have been granted in Oklahoma City during the past ninety days for residences to cost more than $2,000,000 in the aggregate, and this residential building boom still continues. The Cripple Creek Short Line has announced that the road will be electrified. Construction will begin in September and power will be purchased from two central-station companies. Chicago jobbers are now getting practically all of their business outside of the city, with the exception of that from local industrials, and this condition is expected to continue until the end of the deadlock in the building trade. The first electric steel furnace in Omaha, Neb., was installed last week.

**WIRE.**—There has been but little change in the market during the week. The base on rubber-covered wire is from 28 to 30 cents, on weatherproof from about 27½ to 28¼ cents, and on bare wire 27 cents. Jobbers' stocks of rubber-covered wire are improving due to better shipments from the factories. One manufacturer is from three to four months behind in his delivery on weatherproof wire and other factories are also said to be greatly oversold in this line.

**RIGID CONDUIT.**—Card 43 is still being used, and the demand is good, especially from industrials.

**SCHEDULE MATERIAL.**—There is very extensive buying, which is probably in anticipation of an increase in price.

**WIRING PORCELAIN.**—Knobs and tubes are in demand. Prices are firm and there are good jobbers' stocks to draw from.

**FANS.**—Most of the jobbers have sold out, and so far few dealers have complained about their stocks being too large.

**FLEXIBLE ARMORED CONDUCTOR.**—Extensive buying commenced after the price was increased a few weeks ago, and the demand is still growing.

**POLE-LINE HARDWARE.**—Business has been quiet for a few weeks. Higher prices and better business are expected shortly.

**ELECTRIC FLATIRONS.**—Manufacturers have difficulty in supplying the demand. One factory is between three and four weeks behind with its deliveries, but is making a special effort to catch up on back orders.

**FUSES.**—Jobbers are experiencing a good steady demand. Renewable fuses are attracting a lot of attention, and bigger sales of these fuses are expected when each buyer decides which of the many makes and types on the market will be his particular standard.

**FRICTION TAPE.**—Prices are steady and the demand is fairly good.

**WATERWHEELS.**—One manufacturer reports that the domestic market is active but that foreign business is increasing more rapidly. Deliveries are said to be as good as they ever were.

**DOMESTIC REFRIGERATING MACHINES.**—Two of the largest manufacturers are able to make reasonably good deliveries because they are limiting their sales to the territories covered by their existing dealers and branch offices. Orders from other territories are being accepted for delivery next spring.

**METERS.**—House-type alternating-current meters are in good demand, one manufacturer reporting exceptionally large sales. Deliveries are generally good and a price increase is not considered probable.

## BOSTON

Trade is very active, but deliveries at this writing are upset by embargoes due to the strike of railroad shopmen. Stocks in most lines are sufficient to tide over interrupted shipments unless these extend well beyond the present week. Collections are in good shape. Prices hold steady for the most part. Wire did not advance to any extent last week and fiber conduit is a bit easier. Building operations for the year to Aug. 7 total $113,185,000 against $95,920,000 in 1918 to the same date. This rate has been exceeded in but three years since 1900. Conduit is beginning to run a little short and non-metallic flexible conduit is scarce. Labor is greatly unsettled, but except on the Berkshire Street Railway Massachusetts traction strikes are over for the time being. Linemen threaten a strike in the Boston district at this writing. Telephone facilities are expanding rapidly. Retail appliance sales are off a little, due to the vacation period, apparently. The central stations are in some cases encountering a coal embargo, which is unsettling service prospects.

**WIRE.**—Slow-burning is quoted at 30½ cents base, rubber-covered and weatherproof at 30 cents, and bare at 28 cents. Stocks are none too large. Armored flexible conduit single-strip is quoted at $75 per 1000 ft.

**CONDUIT.**—A further advance in price is expected soon. Stocks are getting low and a shortage of various sizes of pipe is imminent.

**ARMORED FLEXIBLE CONDUCTOR.**—Many jobbers are short of this product, though here and there an exceptional stock is reported. Prices are firm.

**NON-METALLIC FLEXIBLE CONDUCTOR.**—The demand for this material outstrips the local supply.

**LAMPS.**—Stocks are in fine shape for the fall trade. Miniature lamps are now plentiful. The season's business in portable lamps has been exceptionally good, though at present the market is a bit dull. Steady prices rule the market.

**ELECTRIC RADIATORS.**—Stocks for fall trade are beginning to appear on local shelves. The high price of coal, it is believed, will be the means of an excellent fall business.

**FLASHLAMPS AND DRY BATTERIES.**—An excellent vacation trade is reported. Deliveries are now good, and

stocks are well maintained. Prices have been steady since the last reduction, and dry cells are quoted at 30 cents to 50 cents retail, according to size.

**FARM-LIGHTING SETS.**—A representative distributer states that July was the best month for sales in the history of the New England trade. Stocks are being maintained, but if shipments should be interrupted to any extent, the local supply of machines would soon be exhausted. An advance of about 10 per cent on Delco sets took effect Aug. 1.

**FUSES.**—The supply exceeds the demand and prices are steady. As yet the expansion of the building trade has not struck the fuse market to any extent, but an increased demand will be felt soon.

**ASBESTOS BOARD.**—Stocks are ample for present requirements. Prices show little change.

**FIBER CONDUIT.**—The market is unusually dull. Prices are showing a tendency to soften. The central-station and industrial demand is far below the capabilities of the manufacturers.

**METERS.**—Increased buying has set in within a fortnight, due probably to the increase in building operations. Manufacturers are now trying to build up stocks to meet the fall demand. One factory producing 12,000 meters a day is 7000 meters behind orders. About Nov. 1 some of the larger contracts will be placed.

**MOTORS.**—The demand for large-sized motors, 50-hp. and 75-hp. rating, has increased within the past week. Small single-phase motors are still none too plentiful in Boston. Motor stocks are in fairly good shape. The market does not appear to be adversely affected by the prospect of auction sales by the government in New England ammunition plants.

**FANS.**—Cooler weather and dull trade sum up the fan situation. Stocks are apparently equal to the summer's needs, and the retailers appear to be carrying along an unusually good supply for the time being in the larger-sized desk types.

**WASHERS AND CLEANERS.**—Stocks are in good shape just now. Trade does not appear to be quite so brisk as of late, owing to the vacation season. No let-up in shipments, however, is to be expected. This year's business will be a record-breaker in washers.

**HEATING DEVICES, DOMESTIC.**—Irons are moving freely, especially for tourists. Percolators are dull.

**IRONING MACHINES.**—The market shows a gradual increase in interest.

## SEATTLE—PORTLAND

Seattle jobbers report business for the past week very quiet, sales showing a decrease over the past three weeks. Retailers' sales have been sustained by an unusual demand for domestic appliances. Both jobbers and dealers report increasing sales of lamps. Fall buying to date has been extremely light, mainly because jobbers in some cases are overstocked. It is believed, however, that there will be a shortage along staple lines due to decreasing production, increasing demand and increasing difficulty experienced in obtaining freight shipments from the East. At present stocks are in A No. 1 shape. Prices along most lines are on an upward trend, and locally it is believed they will continue upward. Actual and threatened strikes among workers in railroad crafts are subjecting lumber shipments from the Northwest to indefinite delay. Manufacturers are exercising more caution in their loading and are scanning more carefully than ever business being offered with a view to holding acceptance to a minimum. Despite the continued operation of all important plants in the Northwest, the chronic shortage in stocks still exists.

Spokane territory reports business in both retail and jobbing lines very active. Prices are trending upward and collections are excellent. Building is active. Dealers report an exceptionally healthy movement of house-wiring devices, fixtures, lamps, etc. Sales of domestic appliances and fans, particularly the latter, are the heaviest in years, and stocks are running low.

The Portland field states that there is the usual activity in household appliances. Stocks, generally speaking, are in good condition except for lines of small motors ranging from fractional-horsepower to 3-hp. sizes. In these there is a serious shortage because of the exceptionally heavy business of the factories in the East and the consequent slowing up in deliveries to the Pacific Coast. It is expected that still further shortages will be experienced. Jobbers, realizing and appreciating the situation, are expected to increase their stocks in as many lines as possible in anticipation of the shortage predicted.

It is reported that the Bend (Ore.) Water, Light & Power Company will immediately begin construction of a 1000-kw. steam plant costing approximately $100,000. Plans for the proposed power plant on Tumale Creek, to cost $125,000, which was to have been built this summer by this company, have been halted. Orders have been issued by the Idaho Power Company for machinery necessary for the installation of an 8000-hp. addition to its power plant at Thousand Springs on Snake River.

**LAMPS.**—Seattle jobbers and small dealers in the Puget Sound district report that sales of lamps for domestic use in standard sizes show a decided increase due to heavy residence building operations and approaching fall. Shipyards and industrial plants, having cut down extensively on night crews, are buying considerably less. Replacement business is very light. Automobile lamps and flashlamps are moving exceptionally well, particularly the former. Stocks are in good condition and shipments are coming through satisfactorily. Prices show no decided change although the tendency is upward.

**RANGES.**—Although sales are not being pushed, the volume is comparatively heavy. Especially is this true in Seattle, Tacoma and Spokane. Sustained sales are accounted for by the number of apartments. Stocks are well balanced. Some ordering for late fall delivery is noted in rural communities. Sales campaigns of small nature are bringing excellent results.

## SAN FRANCISCO

In general the electrical business during the past week has been reported as rather quiet in the larger cities but exceedingly brisk in rural districts and smaller interior cities. Farmers and growers have received topping prices for their crops this season. Workers are receiving high wages, so that money is very plentiful, and this fact, coupled with the crying need for cottages and apartments, is creating a business that will not reach its peak for months to come. Appliance business has slightly slowed up during the summer, but as an indication of the dealers' interest in it it is practically impossible to obtain competent solicitors. One firm reports its retail business during 1918 as over $100,000 on washing machines, although many of these machines were distributed from San Francisco to other coast cities for ultimate sale. Power companies are busy making many extensions and building new lines to relieve their congested districts. In fact, the San Joaquin Light & Power Corporation cannot accept any new range business, despite an insistent demand. Power bonds and stocks are quoted at increased figures on the open market. Credits and collections are good. Stocks are in fair shape. Although rubber-covered wire has been at a premium for several weeks, the receipt of one or two cars has relieved the situation.

**RANGES.**—The new range prices have slowed up the business somewhat, but intensive sales efforts have been diverted to the country districts, where farmers and growers have plenty of money to pay the prices asked. Two or three apartment houses deals are reported, one of fifty-five ranges in Berkeley and another of forty ranges in San Francisco. Two leading hotel supply companies are now featuring electric ranges instead of trailing them behind their gas and coal models. Local stocks are only fair.

**WATER HEATERS.**—Sales are hampered by exceedingly poor factory delivery conditions, and most jobbers report many back orders on their files with no prospects of speedy relief.

# Current Prices of Electrical Supplies

## *New York and Chicago Quotations*

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges or account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

### Armored Conductor, Flexible Steel

*Single-Conductor*

| B. & S. Size | List per 1000 Ft. |
|---|---|
| No. 14 solid | $61.00 |
| No. 12 solid | 71.00 |
| No. 10 solid | 90.00 |
| No. 8 solid | 106.00 |
| No. 6 solid | 145.00 |
| No. 10 stranded | 95.00 |
| No. 8 stranded | 115.00 |
| No. 6 stranded | 160.00 |
| No. 4 stranded | 205.00 |
| No. 2 stranded | 266.00 |
| No. 1 stranded | 315.00 |

*Twin-Conductor*

| | |
|---|---|
| No. 14 solid | 104.00 |
| No. 12 solid | 135.00 |
| No. 10 solid | 185.00 |
| No. 8 stranded | 235.00 |
| No. 6 stranded | 370.00 |
| No. 4 stranded | 575.00 |

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +10% to 20% |
| Coil to 1000 ft. | List to 25% |
| | **No. 12 Solid** |
| Less than coil | +10% to 20% |
| Coil to 1000 ft. | List to 25% |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +10% to 20% |
| Coil to 1000 ft. | List to 25% |
| | **No. 12 Solid** |
| Less than coil | +10% to 20% |
| Coil to 1000 ft. | List to 25% |

DISCOUNT—CHICAGO

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | List |
| Coil to 1000 ft. | 5% |
| | **No. 12 Solid** |
| Less than coil | List |
| Coil to 1000 ft. | 5% |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | $90.00 to $100.00 |
| Coil to 1000 ft. | 85.00 to 82.50 |
| | **No. 12 Solid** |
| Less than coil | List |
| Coil to 1000 ft. | 5% |

### Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |
| Std. pkg. | 15% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% to list |
| 1/5 to std. pkg. | List to 20% |
| Std. pkg. | 23% to 36% |

### Batteries, Dry

NEW YORK

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45 | $0.45 |
| 12 to 50 | .46 | .40 |
| 50 to barrel | .36 | .37 |
| Barrel lots | .329 | .339 |

### Batteries, Dry—*Continued*

CHICAGO

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45 | $0.45 |
| 12 to 50 | .38 | .38 to $0.39 |
| 50 to barrel | .362 | .372 |
| Barrel lots | .332 | .342 |

### Conduit, Metallic Flexible

| Size, In. | Ft. per Coil | List per 100 Ft. |
|---|---|---|
| 3/8 | 250 | $5.00 |
| 1/2 | 250 | 7.50 |
| 5/8 | 100 | 10.00 |
| 3/4 | 50 | 13.00 |
| 1 | 50 | 21.00 |
| 1 1/4 | 50 | 26.00 |
| 1 1/2 | 25–50 | 35.00 |
| 2 | 25–50 | 45.00 |
| 2 1/2 | 25–50 | 52.00 |

NET PER 1000 FT.—NEW YORK

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| 3/8-in. single trip | $75.00 | $63.75— 69.75 |
| 3/8-in. double strip | 75.00— 82.50 | 72.00— 75.00 |
| 1/2-in. single strip | 100.00 | 85.00— 93.00 |
| 1/2-in. double strip | 100.00—110.00 | 96.00—100.00 |

NET PER 1000 FT.—CHICAGO

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| 3/8-in. single strip | $75.00 | $63.25 to $63.75 |
| 3/8-in. double strip | 78.25 | 71.25 |
| 1/2-in. single strip | 100.00 | 75.00 to 85.00 |
| 1/2-in. double strip | 105.00 to 109.00 | 93.00 to 95.00 |

### Conduit, Non-Metallic Flexible

| Size, In. | List per Foot | Size, In. | List per Foot |
|---|---|---|---|
| 3/8 | $0.05½ | 1 | $0.25 |
| 1/2 | .06 | 1 1/4 | .33 |
| 5/8 | .09 | 1 1/2 | .40 |
| 3/4 | .12 | 1 3/4 | .47 |
| 7/8 | .15 | 2 | .55 |
| 1 | .18 | 2 1/2 | .65 |

NET PER 1000 FT.—NEW YORK

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| 3/8-in.— | $35.00 | $27.50 | $26.50 |
| 1/2-in.— | 35.00 | 30.00 | 29.00 |

NET PER 1000 FT.—CHICAGO

| | Less than 250 ft. | 250 to 2500 ft. | 2500 to 10,000 ft. |
|---|---|---|---|
| 3/8-in.— | $42.00–48.00 | $21.00–24.50 | $19.00–22.50 |
| 1/2-in.— | 45.00–53.00 | 22.75–26.50 | 21.25–24.75 |

### Conduit, Couplings and Elbows, Rigid Iron

*Card No. 42*

| Size, In. | Conduit, List per Foot |
|---|---|
| 1/4 | $0.08½ |
| 3/8 | 08½ |
| 1/2 | 08½ |
| 3/4 | 11½ |
| 1 | 17 |
| 1 1/4 | 23 |
| 1 1/2 | 27½ |
| 2 | 37½ |
| 2 1/2 | 58½ |
| 3 | 76½ |

### Conduit, Couplings and Elbows, Rigid Iron—*Continued*

| Size, In. | Couplings, List | Elbows, List |
|---|---|---|
| 1/4 | $0.05 | $0.19 |
| 3/8 | .06 | .19 |
| 1/2 | .07 | .19 |
| 3/4 | .10 | .25 |
| 1 | .13 | .37 |
| 1 1/4 | .17 | .45 |
| 1 1/2 | .21 | .50 |
| 2 | .28 | 1.10 |
| 2 1/2 | .40 | 1.80 |
| 3 | .60 | 4.80 |

DISCOUNT—NEW YORK

| | 1/4 in. to 1/2 in. | 3/4 in. to 3 in. |
|---|---|---|
| Less than 2500 lb. | 1% to 12.1% | 3% to 14.1% |
| 2500 to 5000 lb. | 6% to 15.1% | 8% to 17.1% |

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

| | 1/4 to 1/2 In. | 3/4 to 3 In. |
|---|---|---|
| Less than 2500 lb. | +3% to 3.1% | 2% to 2.1% |
| 2500 to 5000 lb. | +1% to 5.1% | 4% to 7.1% |

(For galvanized deduct six points from above discounts.)

### Flatirons

NEW YORK

| | |
|---|---|
| List price | $6.50 to $7.50 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $6.50 to $7.50 |
| Discount | 25% to 30% |

### Fuses, Inclosed

| 250-Volt | Std. Pkg. | List |
|---|---|---|
| 3-amp. to 30-amp. | 100 | $0.25 |
| 35-amp. to 60-amp. | 100 | .35 |
| 65-amp. to 100-amp. | 50 | .90 |
| 110-amp. to 200-amp. | 25 | 2.00 |
| 225-amp. to 400-amp. | 25 | 3.60 |
| 450-amp. to 600-amp. | 10 | 5.50 |
| **600-Volt** | | |
| 3-amp. to 30-amp. | 100 | $0.40 |
| 35-amp. to 60-amp. | 100 | .60 |
| 65-amp. to 100-amp. | 50 | 1.50 |
| 110-amp. to 200-amp. | 25 | 2.50 |
| 225-amp. to 400-amp. | 25 | 5.50 |
| 450-amp. to 600-amp. | 10 | 8.00 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | 30% |
| 1/5 to std. pkg. | 41% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | 30% |
| 1/5 to std. pkg. | 40% |

### Fuse Plugs

*3-Amp. to 30-Amp.*

NEW YORK

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg. | $6.00 to $8.75 |
| 1/5 to std. pkg. | 5.50 to 7.00 |

Standard packages, 500. List, each, $0.07

CHICAGO

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg. | $8.00 |
| 1/5 to std. pkg. | 7.00 |

Standard packages, 500. List each, $0.07

## Lamps, Mazda or Tungsten

*110 to 125 Volts*

| Regular, Clear: | Std. Pkg. | List Each |
|---|---|---|
| 10 to 40-watt—B | 100 | $0.35 |
| 60-watt—B | 100 | .40 |
| 100-watt—B | 24 | .85 |
| 75-watt—C | 50 | .70 |
| 100-watt—C | 24 | 1.10 |
| 200-watt—C | 24 | 2.20 |
| 300-watt—C | 24 | 3.25 |
| Round Bulbs, 3½-in., Frosted | | |
| 15-watt—G 25 | 50 | .60 |
| 25-watt—G 25 | 50 | .60 |
| 40-watt—G 25 | 50 | .60 |
| Round Bulbs, 3½-in., Frosted: | | |
| 60-watt—G 30 | 24 | .82 |
| Round Bulbs, 4½-in., Frosted: | | |
| 100-watt—G 35 | 24 | 1.15 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than std. pkg | List |
| Std. pkg | 10% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than std. pkg | List |
| Std. pkg | 10% |

## Lamp Cord

*Cotton-Covered, Type C, No. 18*

NEW YORK

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $28.60–$35.01 |
| Coil to 1000 ft | 25.74– 29.17 |

CHICAGO

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $23.00–$32.00 |
| Coil to 1000 | 23.00 |

## Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

| | |
|---|---|
| Net per 100 | $29.70 to $33.00 |

CHICAGO

| | |
|---|---|
| Net per 100 | $29.70 to $33.00 |

## Outlet Boxes

| Nos. | List per 100 |
|---|---|
| 101—A, A 1½, 4 S.C., 6200, 320 | $30.00 |
| 102—B.A., 6200, S.E., 300, A.X., 1½, 4 S... | 30.00 |
| 103—C.A., 9, 4It, B 1½ | 25.00 |
| 106—F.A., 7, C.S., 1½, 3 R | 20.00 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 26%–38% | 20%–33% |
| $10.00 to $50.00 list | 36%–47% | 31%–43% |

DISCOUNT—CHICAGO

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 33%–40% | 24%–32% |
| $10.00 to $50.00 list | 45%–50% | 32%–43% |

## Pipe Fittings

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | 10% |
| 1/5 to std. pkg | 20% |
| Std. pkg | 30% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | 10% |
| 1/5 to std. pkg | 20% |
| Std. pkg | 30% |

## Porcelain Cleats—Unglazed

*Two and Three Wire*

NEW YORK

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg | $17.85 to $22.40 |
| 1/5 to std. pkg | 14.70 to 15.35 |
| Standard package, 2200. List per 1000, $21 to $34 | |

CHICAGO

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg | $17.85–$24.15 |
| 1/5 to std. pkg | 14.70– 21.00 |
| Standard pkg., 2200. List per 1000, $20.00 to 21.00 | |

## Porcelain Knobs

NEW YORK

| Per 1000 Net. | Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C. | Std. Pkg. 4000 N.C. |
|---|---|---|
| Less than 1/5 std. pkg | $13.60–$15.00 | $22.00–$22.40 |
| 1/5 to std. pkg | 10.50– 11.20 | 15.35– 18.00 |

CHICAGO

| Per 1000 Net. | Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C. | Std. Pkg. 4000 N.C. |
|---|---|---|
| Less than 1/5 std. pkg | $13.60–$18.40 | $27.20–$36.80 |
| 1/5 to std. pkg | 11.20– 16.00 | 22.40– 32.00 |

## Sockets and Receptacles

| | Std. Pkg. | List |
|---|---|---|
| ½-in. cap key and push sockets | 500 | $0.33 |
| ½-in. cap keyless socket | 500 | .30 |
| ½-in. cap pull socket | 250 | .60 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +20 to list |
| 1/5 std. pkg | List to 10% |

## Switches, Knife

*250-Volt, Front Connections, No Fuse*

| | |
|---|---|
| **High Grade:** | |
| 30-amp. S. P. S. T | $0.80 |
| 60-amp. S. P. S. T | 1.20 |
| 100-amp. S. P. S. T | 2.25 |
| 200-amp. S. P. S. T | 3.48 |
| 300-amp. S. P. S. T | 5.34 |
| 30-amp. D. P. S. T | 1.20 |
| 60-amp. D. P. S. T | 1.78 |
| 100-amp. D. P. S. T | 3.38 |
| 200-amp. D. P. S. T | 5.20 |
| 300-amp. D. P. S. T | 8.00 |
| 30-qmp. 3 P. S. T | 1.80 |
| 60-amp. 3 P. S. T | 2.68 |
| 100-amp. 3 P. S. T | 5.08 |
| 200-amp. 3 P. S. T | 7.80 |
| 300-amp. 3 P. S. T | 12.00 |
| **Low Grade:** | |
| 30-amp. S. P. S. T | $0.42 |
| 60-amp. S. P. S. T | .74 |
| 100-amp. S. P. S. T | 1.50 |
| 200-amp. S. P. S. T | 2.70 |
| 30-amp. D. P. S. T | .68 |
| 60-amp. D. P. S. T | 1.22 |
| 100-amp. D. P. S. T | 2.50 |
| 200-amp. D. P. S. T | 4.50 |
| 30-amp. 3 P. S. T | 1.02 |
| 60-amp. 3 P. S. T | 1.84 |
| 100-amp. 3 P. S. T | 3.76 |
| 200-amp. 3 P. S. T | 6.76 |

DISCOUNT—NEW YORK

| | High Grade |
|---|---|
| Less than $10 list | +15% |
| $10 to $25 list | 20% |
| $25 to $50 list | 5% |
| | **Low Grade** |
| Less than $10 list | +5% |
| $10 to $25 list | 8% |
| $25 to $50 list | 15% |

DISCOUNT—CHICAGO

| | High Grade |
|---|---|
| Less than $10 list | +25% |
| $10 to $25 list | +10% |
| $25 to $50 list | +5% |
| | **Low Grade** |
| Less than $10 list | +15% |
| $10 to $25 list | 2% |
| $25 to $50 list | 5% |

## Switches, Snap and Flush

*5-Amp. and 10-Amp., 125-Volt Snap Switches*

| | Std. Pkg. | List |
|---|---|---|
| 5-amp. single-pole | 250 | $0.28 |
| 5-amp. single-pole, ind | 250 | .32 |
| 10-amp. single-pole | 100 | .48 |
| 10-amp. single-pole, ind | 100 | .54 |
| 5-amp. three-point | 100 | .54 |
| 10-amp. three-point | 50 | .76 |
| 10-amp., 250-volt, D. P | 100 | .66 |

*10-Amp., 250-Volt Push-Button Switches*

| | Std. Pkg. | List |
|---|---|---|
| 10-amp. single-pole | 100 | $0.45 |
| 10-amp. three-way | 50 | .70 |
| 10-amp. double-pole | 50 | .70 |

## Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 15% to 17% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 25% |

## Switch Boxes, Sectional Conduit

| Union and Similar— | List Each |
|---|---|
| No. 155 | $0.34 |
| No. 160 | .60 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $2.00 list | 18%–20% | List–18% |
| $2.00 to $10.00 list | 28%–30% | 5%–28% |
| $10.00 to $50.00 list | 45%–50% | 10%–47% |

DISCOUNT—CHICAGO

| | Galvanized | Black |
|---|---|---|
| Less than $2.00 list | 30% to 33% | 24% to 25% |
| $2.00 to $10.00 list | 30% to 33% | 24% to 25% |
| $10.00 to $50.00 list | 30% to 45% | 25% to 36% |

## Toasters, Upright

NEW YORK

| | |
|---|---|
| List price | $6.00 to $7.00 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $7.00 |
| Discount | 25% to 30% |

## Wire, Annunciator

NEW YORK

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.52 |
| No. 18, full spools | .51 |

CHICAGO

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.54 to $0.57 |
| No. 18, full spools | .48 to .51 |

## Wire, Rubber-Covered, N. C.

*Solid-Conductor, Single-Braid*

NEW YORK

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 1000 Ft. | 1000 to 5000 Ft. |
| 14 | $16.00 | $12.00 | $12.00 |
| 12 | 21.42 | 21.42 | 17.85 |
| 10 | 29.52 | 29.52 | 22.14 |
| 8 | 41.22 | 37.79 | 30.92 |
| 6 | 59.84 | 54.40 | 48.96 |

CHICAGO

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 2500 Ft. | 2500 to 5000 Ft. |
| 14 | $22.00 | $12.00 | $12.00 |
| 12 | 27.00 | 18.00 | 18.00 |
| 10 | 39.62 | 39.62 | 33.96 |
| 8 | 55.37 | 47.46 | 47.46 |
| 6 | 63.54 | 63.84 | 53.20 |

## Wire, Weatherproof

*Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.*

NEW YORK

| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb | $34.00 |
| 25 to 50 lb | 34.00 |
| 50 to 100 lb | 33.00 |

CHICAGO

| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb | $30.75 |
| 25 to 50 lb | 30.75 |
| 50 to 100 lb | 30.75 |

# NEW APPARATUS & APPLIANCES

## A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

### Resistance Units Mounted on Individual Bases

Recent additions to the products of the Electric Service Supplies Company, Cambria and Seventeenth Streets, Philadelphia, and 50 Church Street, New

RESISTANCE TUBE CAN BE READILY REPLACED

York City, are the form W, type D resistances made in separate units mounted on individual bases. They can be given any reasonable value in ohms, the maker says, and have a continuous rating of 100 watts.

The resistance tube rests upon metal supports and is held in place by heavy metal caps. This provides a very durable construction and allows replacing the resistance tube quickly when necessary. The units have bases 3 in. by 9 in. (76 mm. by 228 mm.), are 2¼ in. (68 mm.) in height over all and weigh 2¼ lb. (7 kg.).

### Replacement Electric Iron Plug

Practically every form of contact used in connecting electric irons can be fitted by the "One-4-All" plug being marketed by the M. Propp Company, 108 Bowery, New York City.

Long life is said to be assured by its

WILL FIT NEARLY ALL ELECTRIC IRONS

use because the contact is made of spring bronze. The outside composition is made from heat-resisting material that is said to withstand extreme heat from electric irons and other appliances. A spring is furnished with the plug so as to maintain the life of the cord. The spring will fit small as well as large cords.

### Powerful Roentgen-Ray Apparatus

The ample power of the Bellevue model Roentgen-ray machine now being made by the Wappler Electric Company, Inc., 173 East Eighty-seventh Street, New York City, for use by hospitals and medical specialists, makes it the fastest apparatus for rapid gastro-intestinal and chest work, according to

SWITCHBOARD IS SEPARATE FROM MACHINE PROPER

the maker. It is equipped with an auto-transformer for controlling the Roentgen-ray current which is very advantageous, especially for the operation of the Coolidge tube.

The switchboard is separate from the machine and contains the auto-transformer, the rheostat, the kilovolt meter and the controlling switches. When the machine is built for alternating-current operation it has, in addition, a polarity indicator. All switches are mounted upon a polished panel and all current-carrying parts are covered by a glass plate, thus affording ample protection against accidental shocks.

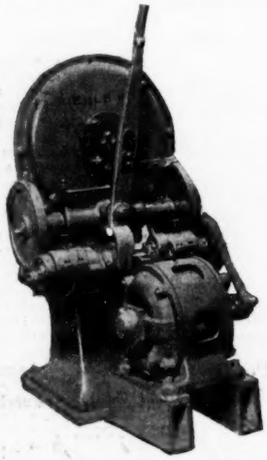
The auto-transformer control is manipulated by means of two selective switches having ten points to each switch. One selective switch furnishes voltages ranging from 30,000 to 120,000 in steps of 10,000 volts each. The second switch acts as an auxiliary to the first and gives the required intermediate and additional voltages in 1000-volt steps. By this arrangement graduations of 1000 volts each are obtainable between the minimum of 30,000 volts and the maximum of 129,000 volts. In addition to the voltage control there is a twenty-step rheostat which is particularly useful in gas-tube work.

### Combination Motor - Driven and Suction Vacuum Cleaner

Three cleaning methods are used in the Premier electric vacuum cleaner recently announced by the Electric Vacuum Cleaner Company, Inc., of Cleveland, Ohio. These are a tufted bristle brush, a pliable rubber-fingered brush and the suction. The brushes are motor-driven and interchangeable. Either can easily be removed and the cleaning be done by the suction alone. The brushes are driven by means of an air-cooled General Electric universal motor, and the power control is an integral part of the pistol grip. The nozzle mechanism is so arranged that adjustments are unnecessary. In this way the makers claim the cleaner is automatically adjusted to get all the dirt regardless of the depth of the nap.

### Electrically Operated Cold-Bend Testing Machine

An electrically operated cold-bend testing machine is being made by the Riehlé Brothers Testing Machine Company, 1424 North Ninth Street, Philadelphia, for bending concrete reinforce-



SILENT CHAIN DRIVE CONNECTS MOTOR AND MACHINE

ment bars, boiler plate, specimens from steel castings, etc., around pins through any angle up to 180 deg.

The rear of the machine is shown in the illustration. At the center of the large circular frame there is a disk with two projecting pins. These pins are so situated that they hit a projection on the clutch lever at the extreme point of travel of the bending arm and consequently disengage the clutch at the end of the required rotation and automatically stop the machine.

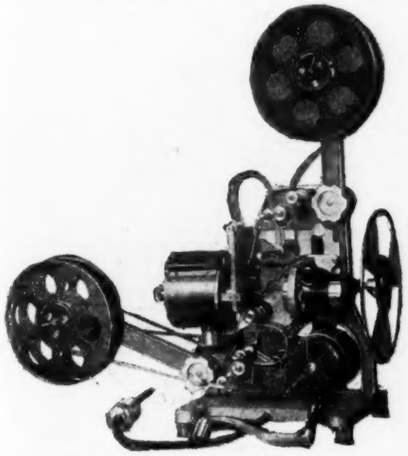
The electric motor operating the testing machine is made by the Northwest Manufacturing Company of Milwaukee and is connected to the machine by a silent chain drive.

## Compact, Portable Safety Motion-Picture Projector

A motion-picture projector for homes and schools using a special, narrow-width, slow-burning film is now being manufactured by the Pathéscope Company of America, Inc., Aeolian Hall, New York City, and is known as the Premier Pathéscope. One of its most important advantages is that the machine can be operated without an inclosing fireproof booth or a licensed operator since both the projector and the films it uses are labeled with the approval of the Underwriters' Laboratories, Inc. As additional features the maker declares that the new projector produces on the screen approximately ten times as much illumination for each watt burned in its lamp as the most efficient illumination system employed on other machines; 62½ per cent of the light illuminating the film is utilized as compared to the customary 32 and 47 per cent, and an absolutely flickerless picture is projected on the screen.

The projector employs a specially designed 14-volt, 2-amp. or 4-amp. gas-filled incandescent lamp in an adjustable socket with a self-centering support.

A Westinghouse universal motor operates the machine and rewinds the film. It is suspended by a hinge pin in such a manner that its weight is



NO INCLOSING BOOTH NEEDED

supported by the belt, on which a constant tension is thus maintained. This method of suspension not only automatically takes up all slack in a stretching belt but also allows the motor to start easily and quickly, reaching full operative speed in about one second after starting, it is pointed out. The speed control consists of a light brake applied to the side of the flywheel by a knurled knob conveniently located near the lens on the operating side of the machine. Motors are supplied for operation on current of 110 to 120 volts and also for 32 volts and 220 volts.

With its film-reel arms folded and the energy circuits attached, the outside dimensions of the projector are 13 in. (33 cm.) long, 8 in. (20 cm.) wide and 13 in. (33 cm.) high. The weight of the machine including the motor is 23 lb. (10 kg.). For convenience in transportation a "suitcase" to hold the projector can be obtained and also a metal carrying case with a baseboard.

## Electric Vacuum Cleaner

Perfect balance is claimed to be one of the main features of the "Universal" vacuum cleaner just announced by Lan-

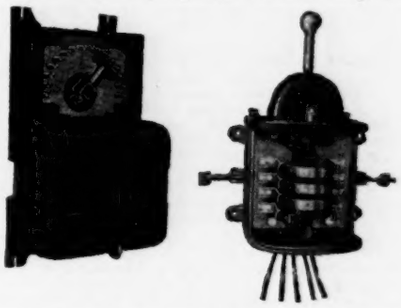
ALUMINUM CASING ALLOWS LIGHT WEIGHT

ders, Frary & Clark of New Britain, Conn. The motor is mounted horizontally and is equipped with self-feeding oil wells. The brush is gear-driven and will take care of lint and threads on the carpet. Lightness in weight is obtained by the use of aluminum for the casing instead of steel. The rubber swivel wheel will not mar the floor.

## Master-Unit Control for Printing-Press Motors

A small single-phase printing-press motor can be inched in either direction or brought up to fifteen different predetermined speeds by the aid of a master switch and a transformer-type dial regulator recently brought out by the Kimble Electric Company, Chicago, Ill. Once the regulator has been adjusted to give the desired speed for any job, the motor is operated entirely by the master switch and the speed regulator need not be disturbed until a change in the class of work requires a setting for a different speed. The switch on the speed regulator breaks the circuit to one transformer tap before it connects to another and does not short-circuit the transformers.

The master-switch contains only eight fingers compared with thirty in



REGULATOR OPERATES MOTOR AT SPEED PREDETERMINED BY SWITCH

the company's former drum-type controller. Furthermore, no magnetic switches are required with this system of control. The handle of the master-switch has a back and forward motion and the handle may be lifted out of its socket by the pressman if he desire to leave the press inoperative. To prevent the pressman from throwing the control lever of the master switch from the running to the reverse position unintentionally, with consequent damage to the belt and press, a small interlocking lever is mounted behind the main control lever. This interlocking prevents the control lever from entering the reverse position until the interlocking lever is moved to the opposite side. The master switch can be furnished with an electric trip and dynamic braking to meet the requirements of presses equipped with mechanical feeders.

## NOTES ON RECENT APPLIANCES

### Farm-Lighting Plant

Two models of 32-volt farm-lighting plants—one consisting of gasoline engine, generator and storage batteries and the other without batteries—are being made by the Stearns Motor Manufacturing Company of Ludington, Mich.

### Flashlight with Extra Cells

The Stuart Products Company, 440 Green Street, Chicago, is manufacturing the "Make-ur-own" flashlight and cells which are assembled by the user. The cells fit any standard tubular flashlight.

### Electric Envelope Sealer

The Standard Envelope Sealer Manufacturing Company of Somerville, Mass., has brought out model M envelope sealer, which is driven by an electric motor.

# *Manufacturers' Activities*

MAZDA LAMPS FOR FORDS.—The new inclosed models of Ford cars are using, and the open models will use, a 6-volt to 8-volt Mazda single-contact-base headlight lamp with an auxiliary lamp in the headlight reflector, instead of the 9-volt lamp formerly used from the magneto lighting system. These 9-volt lamps will, however, remain on lamo schedules.

PUGET SOUND COMPANY REMOVES OFFICES.—The general offices of the Puget Sound Traction, Light & Power Company, Seattle, Wash., with the exception of those of President A. W. Leonard, Vice-president McGrath, and General Counsel James B. Howe have been moved to the Electric Building at Seventh and Olive Streets. The executive offices will remain in the Stuart Building

HOLTZER-CABOT REWARDS OLD EMPLOYEES.—The Holtzer-Cabot Electric Company, Roxbury, Mass., has presented every employee of ten years' standing or over with $100. In each case the money was accompanied with a personal letter of appreciation from President C. W. Holtzer, which expressed pleasure in the term of service of the recipient and in the loyalty of the 190 individuals to whom the bonus was awarded. About 700 persons are now employed in the company's factory.

MISUSE OF TRADEMARKS. — The Council of National Defense announces that one of the new and extremely difficult problems which vast expansion of international trade and newer development of international advertising have brought with them is the protection of trademarks of articles or firms with international reputations in foreign countries. It is stated that already piratical use of trademarks in foreign countries as a weapon in trade competition has gone very far, especially in Latin-American countries, and that some American products have been registered by German concerns.

STANDARD TRANSFORMER COMPANY.—The Standard Transformer Company of Warren, Ohio, has been incorporated for the purpose of manufacturing a complete line of bell-ringing transformers. An agreement has been made between this company and the Packard Electric Company of Warren whereby the Standard company will in the future manufacture the bell-ringing transformers which were placed on the market by the Packard company about ten years ago. The entire line of transformers will be inclosed in blue-glazed porcelain cases. W. F. Parker, general sales manager of the Packard Electric Company, is president of the Standard Transformer Company, and W. A. Wolcott, president of the Packard Electric Company, is secretary-treasurer of the Standard Transformer Company.

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THE HAMILTON-BEACH MANUFACTURING COMPANY, Racine, Wis., will erect a four-story additional building, 60 ft. by 350 ft. The company will not build a new plant at Syracuse, N. Y., as contemplated a short time ago.

THE ECONOMY ELECTRIC COMPANY, a large dealer in electrical supplies at Worcester, Mass., will shortly enlarge its Foster Street quarters by the addition of four floors of an adjoining building for storage purposes. About 18,000 sq.ft. of additional floor space will be utilized.

R. V. WALLER has been appointed advertising manager of the Belden Manufacturing Company, Chicago, Ill. Mr. Waller has recently returned from France, where he was in the air service of the United States Army for twenty-one months. Before going into the service he was in the sales department of the Belden company. Mr. Waller succeeds F. T. Bangs as advertising manager of the Belden company.

C. H. GROVE, who has been discharged from the United States Navy, has become Toledo representative for the Commercial Electric Supply Company, Detroit, Mich. Mr. Grove is a graduate of the University of Illinois in the class of 1911, and he has been employed by the Westinghouse Electric & Manufacturing Company in its apprenticeship course and in its sales department at Chicago. His last work for the Westinghouse company before entering the navy included handling the contract for the hydroelectric development of the Rock Island (Ill.) arsenal.

ALLEN RAMSEY has joined the engineering staff of the Delta-Star Electric Company of Chicago. Previous to his acceptance of this appointment he was designing engineer for the New York & Queens Electric Light & Power Company of New York, and prior to that an electrical engineer with Sargent & Lundy of Chicago.

JAMES R. KEARNEY, who for the last fourteen years has been connected with W. N. Matthews & Brother, has just been made western manager of the line material division of that company, with headquarters at Chicago. He will cover all of the United States west of Pittsburgh, and Canada from Winnipeg west, supervising the line-material division sales and being in charge of all salesmen traveling that territory.

THE COMSTOCK ASSOCIATE COMPANY, INC., branch of the L. K. Comstock Company, New York, electrical engineering contractors, has established a new department, known as the Comstock household service, for the sale of electrical merchandise. Display rooms are to be opened and fully equipped, and it is planned to have an outside sales force selling direct to the consumer to canvass in special sections. The company plans to give the consumer the choice and selection of any make of device that he may desire rather than push any one article or make of article. Repair and delivery service are also part of the plan. The company will determine from this store the advisability of extending this work to all of its branch offices throughout the country. The company anticipates securing exclusive distributing rights of several of the most useful household commodities. Joseph V. Guilfoyle, who is in charge of this new department, is well known as an electrical merchant. While he was manager of the appliance bureau of the United Electric Light & Power Company, New York City, he was chairman of the merchandising committee of the National Electric Light Association. Later he was associated with the Western Electric Company in its New York office as specialist in socket-device sales. For a while he was connected with the Western New York Utilities Company at Medina, N. Y., after which he joined the army, where he received the commission of captain in the Seventeenth Engineers.

J. V. GUILFOYLE

DWIGHT P. ROBINSON & COMPANY, INC., 61 Broadway, New York, announce that they have been awarded a contract by the Duquesne Lighting Company of Pittsburgh to design and construct a power station at Cheswick, Pa., near Pittsburgh, to have an ultimate capacity of 300,000 kw., of which one unit of 60,000 kw. is to be installed initially. The work consists of a new power station building with the necessary complement of boilers, piping, electrical apparatus, coal-handling devices, coal storage, etc. It is anticipated that the work of installing the first unit will require about twelve months.

THE ELECTRIC PRODUCTS COMPANY, Cleveland, Ohio, has just opened a branch office in Detroit, Mich., at 2306 Dime Bank Building, with E. H. Bridge, district manager, in charge.

THE M. B. AUSTIN COMPANY, Chicago, makes the following special announcement: "Trico renewable cartridge fuses have been regularly tested by the Underwriters' Laboratories and they comply with all the necessary requirements up to and including 600 amp. in both the 250-volt and 600-volt classification."

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, held a sales conference at its Bethlehem (Pa.) works during the week of July 7. Those in attendance were G. L. Crosby, sales manager, New York; M. Frankel, assistant sales manager, Chicago; C. M. Hunt, New York; C. G. Kahant, export manager, New York; W. G. Merowit, Buffalo; C. H. Nicholson, Detroit; F. C. Perkins, Philadelphia; W. G. Pieksen, St. Louis; F. W. Ryan, Chicago; W. J. Shire, New York, and J. E. Wood, Cleveland. I. E. Hall, assistant works manager, and W. H. Pugh, superintendent, entertained the men at several functions. The conference ended in the company's New York office, at 233 Broadway, on July 10.

THE MORISON ELECTRICAL SUPPLY COMPANY, INC., 15 East Fortieth Street, New York City, is the name of a new wholesale and retail electrical supply company which has been organized with Charles T. Morison, president, formerly of the firm of Hartt & Morison, at 780 Sixth Avenue, New York City. Mr. Morison disposed of his interest in the firm of Hartt & Morison some time ago, to establish his business on a somewhat more extensive basis. His company intends to open branch stores in other sections in the early future. Besides his connection with the Hartt & Morison Company, Mr. Morison was at one time manager of the Manhattan Electrical Supply Company store and later proprietor of the Madison Electrical Supply Company of New York City.

THE GURNEY BALL BEARING COMPANY, Jamestown, N. Y., held its semi-annual sales convention from July 30 to Aug. 1. Members of the engineering metallurgical and production departments attended the sessions, which were productive of an increased knowledge of the various problems of manufacture and application. The sales engineering force now includes L. J. Bohan and George C. Warner, with headquarters at Chicago, the former having charge of the Northwestern territory, and the latter the Southwestern. R. H. Fox, who will represent the company in Michigan, was formerly connected with the United States Ordnance Department and previous to that was with the Fafnir Company. H. C. Marsh, formerly with the Westinghouse Company, will handle Ohio territory. C. A. Call, in charge of the Eastern district, was formerly with the General Electric and Terry Steam Turbine companies. A. W. Eckberg and M. T. Denslow are connected with the home office. J. T. R. Bell is general sales manager.

DANTZIG, PFEIFFER & RITT, 500 West 116th Street, New York City, is the name of a firm of consulting mathematicians recently formed to handle all problems arising in industry for the solution of which the knowledge of a mathematical specialist may be necessary. The firm is composed of Dr. T. Dantzig, Dr. G. A. Pfeiffer and Dr. J. F. Ritt. Each member has been privately engaged for some time in work of this nature, in addition to his other professional activities, and it was at the suggestion of clients that the decision was made to set up a consulting service which would extend to the industrial world the resources of modern pure and applied mathematics. Dr. Dantzig is a graduate of the University of Paris and of the Ecole Supérieure d'Aéronautique et de Construction Mécanique. He has taught at Indiana University and at Columbia. During the war he was in charge of the mathematical work of the instrument section of the United States Ordnance Department. Dr. Pfeiffer received the degree of mechanical engineer from the Stevens Institute of Technology and the degree of doctor of philosophy from Columbia University. He has taught mathematics at Harvard, Princeton and Columbia. He is an associate editor of the *Annals of Mathematics*. Dr. Ritt took the degree of Ph.D. at Columbia University. He was for three years at the Naval Observatory and has since taught mathematics at Columbia. During the war he was one of the chief ballisticians in the United States Ordnance Department.

THE BABCOCK & WILCOX COMPANY, New York, has moved its Seattle office to the L. C. Smith Building.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the appointment of J. L. Canby as district manager of sales at Chicago, succeeding Nelson B. Gatch, who has been transferred to New York as district manager of sales.

O. J. RIDENOUR, who for four years was general manager of the Star Expansion Bolt Company and until recently the secretary and assistant general manager of the Wright-Martin Air Craft Corporation, has become associated with the National Chain Company as vice-president and general manager.

L. S. MONTGOMERY, since his release from government service a few months ago, has been in charge of a new electrical department of the Fairbanks Company, Birmingham, Ala. The addition of an electrical department to the mill-supply business of this company is a new development. Previous to this connection and his service in the war, Mr. Montgomery was connected with the American Conduit Manufacturing Company in charge of its New York office. Before that connection he was for a number of years Southern district manager of the National Metal Molding Company in Atlanta. In the South he is well known in electrical circles.

THE HAZARD MANUFACTURING COMPANY of Wilkes-Barre, Pa., manufacturer of insulated wire, and cable, on July 1 opened a new sales office and warehouse at 1415 Wazee Street, Denver, Col., in charge of Ernest P. Kipp, district manager. The Denver office will cover the intermountain district, including in its territory Colorado, Wyoming, Montana, Idaho, Utah, New Mexico and the western portions of Nebraska and South Dakota. Mr. Kipp, who has had sixteen years' experience in the wire industry, was captain in the United States Engineers and has received his honorable discharge. A full stock of wire rope and rubber-insulated wire is carried at Denver.

THE WELLMAN-SEAVER-MORGAN COMPANY of Cleveland, Ohio, manufacturer of hoisting engines, hydraulic turbines, mining and other heavy machinery, has recently received an order from the Hydro-Electric Commission of Ontario for two turbines of 52,500 hp. each, the largest in the world, for installation at Niagara Falls. In the last four years the company's business has increased enormously. The gross business in 1915 amounted to $1,038,945; in 1916 to $2,491,518; in 1917, to $4,687,929 and in 1918 to $7,559,488. Unfilled orders on hand Jan. 1, 1919, amounted to $4,670,995. The company states that the net earnings for the first four months of the current year compare favorably with the earnings for the same period of last year, and the orders in hand and under negotiations give assurance of a satisfactory volume of business in profits for the coming year. The officers of the company are: Edwin S. Church, president and general manager; S. H. Pitkin, first vice-president; George Burrell, second vice-president; W. H. Cowell, secretary and treasurer.

THE FRANCIS A. VAUGHN MANUFACTURING COMPANY, which was recently incorporated, has its general offices in the Security Building of Milwaukee, Wis., while the factory is at 95 Thirty-fifth Street, Wauwatosa, Wis., in a two-story and basement building, 30 ft. by 135 ft. The new company is now manufacturing a line of labor-saving equipment, called "Jiffy products," which consists of Jiffy adjustable jacks, column clamps, scaffold hangers and brace clamps, also a Jiffy punch and a Jiffy cutter for metal work. The company owns the selling and manufacturing rights for this apparatus and sells the products through the Paul W. Koch Company, of 19 South Wells Street, Chicago. Material and manufactured stock for jacks, clamps and hangers were taken over from the Garage Equipment Manufacturing Company, which formerly manufactured these products. The new company is also taking over material and tools used by the Kalamazoo Sheet Metal Manufacturing Company, which formerly made the punches. In addition, the new company manufactures Jiffy cutters for the Universal Tool & Appliance Company of Milwaukee. The factory is equipped with machinery and rough material and is operating at the present time. The company is incorporated for $50,000 and has the following officers: Francis A. Vaughn, president; L. Vaughn, vice-president, and G. V. Martin, secretary and treasurer.

## Foreign Trade Notes

ELECTRIC LAMPS IN SIBERIA.—According to figures obtained from the Russian-American Committee for the Far East, 458,235 lb. of electric lamps are on hand in the warehouses of the Vladivostock custom houses.

EQUIPMENT WANTED IN GREECE.—The president of the French Chamber of Commerce in Greece has recently issued a statement to the effect that insulation tubes and wooden molding for small electrical installations are urgently needed in Greece and that immediate orders could be obtained for them.

USED MOTORS BRING HIGH PRICES IN ENGLAND.—At a sale conducted in Glasgow by the disposal board of the British Ministry of Munitions, $455 was paid for a 1-ton electric overhead runway hoist which cost when new $220. For a 10-hp. shunt-wound direct-current electric motor, 240 volts, 790 r.p.m., $375 was paid, a profit of $120, and for a similar motor, with double the power, which cost $367, $610 was paid.

INCREASES IN FRENCH IMPORT DUTIES.—The French law of July 8, 1919, has imposed higher duties upon imports of electrical apparatus along with other materials entering France. This represents the relation between the prices of 1913 and those of 1918. To determine the amount of duty now payable, the former specific rates of duty are to be multiplied by the following coefficients; dynamo-electric machines, 2.9; electro and electrotechnic apparatus, 2, and storage batteries, 3.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The chairman of the Council of Credit Institutions of Georgia (Transcaucasia) (No. 120,197) desires electric supplies and accessories, generators, electric motors and turbines in exchange for products from that region.

The purchase of electric generators is desired by a firm in Switzerland (No. 30,149). Quotations should be given c.i.f. European port. Terms, payment through bank on arrival of goods.

A firm in Brazil (No. 30,175) desires to secure the representation of American steamship companies, and agencies for the sale of electrical goods. Correspondence may be in English.

Catalogs of electrically operated machines for the manufacture of buttons from ivory nuts are requested by a man in China (No. 30,142), with a view to establishing a factory in his native port. Correspondence and catalogs may be in English.

A firm in Italy (No. 30,124) desires to secure an agency for the sale of electrical supplies. Catalogs and price lists are requested. Correspondence should be in Italian or French.

The representation of manufacturers of small electrical novelties and appliances, including medical and dental apparatus, is desired by a man in Spain (No. 30,054). Correspondence may be in English.

A company in Argentina (No. 30,057) wishes to represent American firms dealing in electrical materials. Correspondence should be in Spanish.

The agency on a commission basis for all of Italy for electrical supplies is desired by a firm in that country (No. 30,058). Correspondence may be in English.

A firm in Switzerland (No. 30,060) wishes to secure the agency for the sale of engines driven by electricity (horizontal 20 hp. to 120 hp.), compressors and cranes. Correspondence may be in English.

The purchase and agency is desired by a firm in Belgium (No. 30,069) for the sale of electrical appliances, such as switches and sockets. Quotations should be given c.i.f. Antwerp. Correspodence may be in English, but catalogs should be in French if possible.

A man from Finland (No. 30,106) who is in this country for a short time desires to purchase electric motors.

## Trade Publications

DISTRIBUTION-TYPE TRANSFORMERS.—The Wagner Electric Manufacturing Company of St. Louis, Mo. has just published bulletin No. 119, which tells about its distribution-type transformers.

INDICES.—The General Electric Company, Schenectady, N. Y. has issued an index to its descriptive bulletins and sheets, and also an index to its supply parts bulletin. Both these indexes are dated July, 1919.

ELECTRICALLY DRIVEN BUTTER CHURN.—The Taylor Brothers Churn & Manufacturing Company of 2400 Colman Street, St. Louis, Mo., has prepared a circular about its model No. 5 electrically driven butter churn.

CHAIN DRIVE. — The Morse Chain Company of Ithaca, N. Y., is now distributing a revised edition of its catalog No. 14, which covers large power drives; that is, chain drives for motors ranging from 100 hp. up to 5000 hp.

CIRCUIT BREAKER. — Under-voltage-type circuit breakers for direct-current and alternating-current operation are the subjects of bulletin sheet No. 74, which has just been issued by the Roller-Smith Company, of 233 Broadway, New York City.

SMALL-SIZE STORAGE BATTERY CHARGER.—The France Manufacturing Company, West 104th Street and Berea Road, Cleveland, Ohio, is circulating bulletin No. 28 about the new F-F "Bantam battery booster," a small-size charger for storage batteries.

PORTABLE MOTION-PICTURE PROJECTOR.—The Pathéscope Company of America, Inc., Æolian Hall, New York City, has just issued an illustrated booklet descriptive of the new "Premier Pathéscope," which is a portable motion-picture projector not requiring an inclosing booth.

ELECTRICALLY OPERATED RAILROAD EQUIPMENT.—Catalog No. 145 from the Whiting Foundry Equipment Company of Harvey, Ill., has for its subject railroad equipment and covers locomotive hoists, coach hoists, frames, transfer tables and turntable tractors, as well as car-wheel foundries.

OVERLOAD AND UNDERLOAD TYPE CIRCUIT BREAKERS.—Bulletin sheet No. 73 is being distributed by the Roller-Smith Company of 233 Broadway, New York City, to cover its "Standard" type circuit breakers. Plain overload circuit breakers for alternating-current and direct-current operation are shown and described, and also underloadtype breakers for direct-current operation only.

## New Incorporations

THE IVOR (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000. The officers are: T. A. Saunders, president, and L. C. Pulley, secretary.

THE CONTINENTAL STORAGE BATTERY COMPANY of Ottawa, Ont., has been incorporated with a capital stock of $50,000 by Nelson C. Kerr, Charles E. Taylor, Alexander E. Bannerman and others.

THE R. W. LILLIE CORPORATION of New York, N. Y., electrical sales engineers, has been chartered with a capital stock of $25,000 by R. W. Lillie of Greenwich, Conn.; L. Skipwith, Cornell Club, and R. J. Knoeppel, 5 Beekman Street, New York City.

THE PORTABLE ELECTRIC CURRENT COMPANY of New York, N. Y., has been incorporated by W. A. Blank, L. B. Kanter and C. B. Plante, 761 Lincoln Place, Brooklyn. The company is capitalized at $2,000,000, and proposes to manufacture storage batteries, etc.

THE BATTERY ENGINEERING & SUPPLY COMPANY of Ottawa, Ont., has been incorporated with a capital stock of $50,000 by Arthur Ellis, Redmond Code, M. K. Herbert and others. The company proposes to manufacture motor cars, batteries, machinery, electrical supplies, etc.

## New England States

AUGUSTA, ME.—The Public Utilities Commission has issued an order that the Cumberland County Power & Light Company extend its transmission lines from the end of its present line near Gray Corner along the Poland Spring road and through the Dry Mills settlement.

BOSTON, MASS.—The Nelson Corporation is planning to erect a new plant, consisting of a one-story manufacturing building, 400 ft. by 500 ft., a two-story receiving building, 80 ft. by 400 ft., a four-story office building, 60 ft. by 120 ft. and a two-story power house, 84 ft. by 87 ft.

BROCKTON, MASS.—The contract for lighting the Brockton fair grounds has been awarded to Snow Brothers of Brockton, at $7,000. The contract calls for 130 lamps, including fourteen floodlights.

MANCHESTER, N. H.—Contract has been awarded to the Manchester Traction, Light & Power Company for the installation of a new ornamental lighting system on Elm Street.

HARTFORD, CONN.—Contract will soon be awarded by Ford, Buck & Sheldon, engineers, Prospect Street, for an addition to the factory of the Arrow Electric Company, 99 Hawthorne Street, to cost about $40,000.

NEW HAVEN, CONN.—The business men of Washington Avenue have petitioned the City Council for the extension of the ornamental lighting system on that thoroughfare from Congress Avenue to Howard Avenue.

## Middle Atlantic States

BROOKLYN, N. Y.—Plans are under consideration by the Brooklyn Rapid Transit Company, 85 Clinton Street, for the construction of a new brick and stone power station at Kent Avenue and South Sixth Street for increased operations.

HUDSON FALLS, N. Y.—Plans are being prepared by the Union Bag & Paper Corporation, Woolworth Building, New York City, for the erection of a factory building at Hudson Falls, to cost about $500,000.

MIDDLETOWN, N. Y.—Sealed proposals for the construction, heating, plumbing and electric work will be received by the State Hospital Commission at Albany, N. Y., for the mortuary and laboratory building, Middletown Homeopathic State Hospital, Middletown, N. Y. Proposals will be received until 3 o'clock p. m. on Wednesday, Aug. 20. Proposals shall be inclosed in an envelope furnished by the state architect, sealed and addressed, and shall be accompanied by a certified check in the sum of 5 per cent of the amount of the proposal. The contractors to whom the awards are made will be required to furnish surety company bond in the sum of 50 per cent of the amount of the contract within thirty days after official notice of award of contract and in accordance with the terms of Specifications Nos. 3301, 3311, 3312 and 3313. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Middletown State Hospital, Middletown, N. Y., at the New York Office of the Department of Architecture, room 618, Hall of Records Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of hhe state architect, L. F. Pilcher, Capitol, Albany, N. Y.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for alterations and improvements in its three-story power plant at 123 East Eighty-third Street, and contract has been awarded.

NEW YORK, N. Y.—The Sloss-Sheffield Steel & Iron Company, 56 Liberty Street, New York, is planning to erect a power plant.

NIAGARA FALLS, N. Y.—The Niagara Falls Gas & Electric Company is planning to erect a new plant to consist of seven buildings at Buffalo Avenue and Twenty-second Street, to cost about $200,000.

PERSIA, N. Y.—The Iroquois Utilities, Inc., has filed an application with the Public Service Commission for permission to make extensions and improvements to its power plant in Persia and Leon.

PORT ALLEGANY, N. Y.—The Borough Council is considering the installation of a

# *Construction*

**News of Projects, Plans, Bids and Contracts. Notes on Work Under Way**

municipal electric light plant. The cost of the plant complete is estimated at about $45,000.

WESTFIELD, N. Y.—Work is progressing rapidly on the construction of the new two-story plant and power house of Armour & Company, Chicago. The new plant will cost in the neighborhood of $300,000.

BRUNSWICK, N. J.—Acting Supervising Architect James A. Wetmore, Treasury Department, Washington, D. C., has prepared plans for the installation of new heating equipment, at the local post-office building.

NEWARK, N. J.—The Seton Leather Company has awarded contracts for the construction of the new tannery addition to its plant, with one-story boiler house, to the Essex Construction Company, 87 Academy Street. The cost of these additions is estimated at $55,000 and $10,000 respectively.

NEWARK, N. J.—Louis Sacks, Wilson Avenue, has had plans prepared for the construction of a one-story brick boiler plant at the works. The structure is estimated to cost $5,000.

NEW HOPE, N. J.—Plans are being considered by the New Hope Electric Company for alterations and improvements and the installation of new equipment at its power plant.

PERTH AMBOY, N. J.—The lighting committee of the Board of Aldermen has under consideration plans for the installation of electrical machinery at the municipal light and power plant.

PERTH AMBOY, N. J.—The Board of Public Utility Commissioners has instructed the Jersey Central Traction Company to make improvements and extensions to its plant and system at the Keyport-Perth Amboy division, the Matawan-Keyport division and at Atlantic Highlands.

PLAINFIELD, N. J.—A company is being organized under the name of the New Jersey Trackless Trolley Company to construct and operate a trackless trolley between Plainfield, South Plainfield and Metuchen. The cost of the system is estimated at $125,000.

SOUTH AMBOY, N. J.—Plans are under consideration by the City Council for extensions and improvements in the electric street-lighting system, including the installation of new lighting units of increased capacity.

TRENTON, N. J.—The City Commission is considering plans for improvements in the municipal electric lighting system.

BOLIVAR, PA.—The installation of an electric light plant in Bolivar is reported to be under consideration.

CARLISLE, PA.—A power plant will be erected by C. H. Masland & Sons, Philadelphia, Pa., in connection with the proposed carpet-manufacturing plant at Carlisle. The company is asking for bids.

COLWYN, PA.—The Borough Council has awarded the Delaware County Electric Company of Lansdowne a contract for lighting the streets by electricity. The contract provides for forty lamps and will become effective Oct. 1. At present gas lamps are used. Post office address, R. F. D. from Darby.

CRAFTON, PA.—Plans have been made by the Duquesne Light Company, Pittsburgh, for the construction at Crafton of a two-story substation on Noble Street, about 24 ft. by 83 ft., with one-story rear wing. The structure is estimated to cost about $45,000.

GETTYSBURG, PA.—The Town Council is understood to be considering plans for the installation of a new municipal electric plant.

HERSHEY, PA.—The Hershey Chocolate Company will erect a power plant in connection with the proposed addition to its local plant to cost about $500,000.

NANTICOKE, PA.—A new brick and concrete boiler plant, two stories in height, about 90 ft. by 100 ft., will be erected at the local works of the Duplan Silk Company, Hazleton, Pa. Plans for the structure are now being prepared. Emil Buehler is local manager.

PITTSBURGH, PA.—The Beaver County Light Company has filed notice with the Public Service Commission of a bond issue for $24,000 to provide for general business expansion.

READING, PA.—Plans have been filed by the Philadelphia & Reading Railway and contract awarded for the construction of a one-story brick, steel and concrete power plant. The structure will be about 30 ft. by 50 ft. The Robert E. Lamb Company, 845 North Nineteenth Street, Philadelphia, is the contractor.

DOVER, DEL.—The Central Power Company, Chicago, Ill., a Delaware corporation, has filed notice of an increase in its capital from $1,850,000 to $3,000,000 to provide for general business expansion.

BALTIMORE, MD.—Contract has recently been awarded to George R. Bullen, Baltimore, by the board of awards, for the installation of a new heating plant at Public School No. 63, Gough and Wolfe Streets.

WASHINGTON, D. C.—Sealed proposals will be opened at 3 p. m. Sept. 8, 1919, for furnishing materials for the construction of the United States Post Office at Carroll, Iowa, including building materials, plumbing, heating, electrical work, etc., in accordance with drawings, specifications and bills of quantities attached thereto copies of which may be obtained from the custodian at Carroll, Iowa, or at the office of James A. Wetmore, acting supervising architect, Treasury Department, Washington, D. C.

CHARLESTON, W. VA.—The Virginia Rubber Company will erect a power plant in connection with its proposed new rubber-manufacturing plant. The company was recently incorporated with a capital of $1,200,000.

CLARKSBURG, W. VA.—Bonds to the amount of $300,000 have been voted for construction of waterworks system and power plant. S. G. Highland is secretary and general manager of water board.

KENOVA, W. VA.—Fifty thousand dollars will be expended by the Ohio Valley Electric Railway Company for improving its plant at Kenova and $75,000 for improvements in Russel, Ky.

PARKERSBURG, W. VA.—Plans have been prepared by the Vitrolite Company, 1133 West Washington Street, Chicago, Ill., for an addition, 300 ft. by 400 ft., one story and basement, to its local plant. The company manufactures composition products.

PIEDMONT, W. VA.—The Baltimore & Ohio Railroad is said to be considering plans for the complete electrification of its system over the Seventeen-Mile Grade district.

WELLSBURG, W. VA.—The electric power plant of the Wellsburg Light & Power Company was recently destroyed by fire, causing a loss of about $100,000.

CHATHAM, VA.—J. H. Hargrave, Jr., has purchased the electric lighting plant at Chatham for the sum of $23,000.

## North Central States

ALLEGAN, MICH.—Plans are being prepared by the McCormick Company, architects and engineers, Century Building, Pittsburgh, Pa., for a creamery and dairy, to include power house, 40 ft. by 50 ft. The cost is estimated at about $100,000.

MARQUETTE, MICH.—Plans have been prepared for the power plant to be erected by City Commission of Marquette. The plans call for a building of brick and steel, reinforced-concrete construction, including steam heating. The specifications include electrical equipment. Contracts will be let by city clerk.

MARYSVILLE, MICH.—Plans are being prepared by Smith, Hinchman & Grylls, architects and engineers, 710 Washington Arcade, Detroit, for the first unit of the proposed manufacturing plant, consisting of power plant and two manufacturing buildings, to be erected along the St. Clair River by Wills & Lee, Book Building, Detroit.

CLEVELAND, OHIO.—The Chandler Motor Company, East 131st Street and St. Clair Avenue, is planning to erect an addi-

room to machine shop, to cost about $200,000.

CLEVELAND, OHIO.—Plans are under consideration by the Cleveland Automobile Company, 300 East 131st Street, for the erection of a factory on Euclid Avenue and London Road, to cost about $750,000.

CLEVELAND, OHIO. — The Sommer Adams Company, 2934 East Fifty-fifth Street, contemplates the construction of a factory and power house, to cost about $75,000.

CLEVELAND, OHIO.—The Willard Storage Battery Company is planning to erect an addition to its plant.

NEWARK, OHIO.—W. S. Weiant & Sons are planning the installation of a new power plant. Bodenstein & Surman of Cincinnati are preparing plans.

NEW CONCORD, OHIO.—It has been voted to purchase a waterworks and electric light plant.

LEXINGTON, KY. — Preparations are being made by the G. F. Vaughan Tobacco Company for the erection of a large big-leaf-tobacco handling plant in Lexington, to cost about $250,000. The equipment will include redryers, boilers, heaters, hydraulic pumps, orderers, trucks, tools, etc. E. K. Frankel is architect and construction engineer.

INDIANAPOLIS, IND.—The Springer-McComas Grain Company is planning to erect a transfer elevator to cost about $60,000, exclusive of site. Two grain dryers and one cleaner will be installed.

OAKLANDON, IND.—The County Commissioners have decided to erect two additional buildings at the county tuberculosis hospital grounds near Oaklandon now and to construct other buildings needed next year. A service building, two stories high, for use as dining-room and kitchen quarters and for residence of employees, and a power house to provide heating facilities for all buildings on the grounds will be built.

PERU, IND.—The Modern Refrigerator Company is planning to erect two large buildings at its plant. The capital stock of the company will be increased from $25,000 to $100,000.

PORTLAND, IND.—The directors of the Union Traction Company of Anderson are negotiating for the purchase of the power plant at Detamore and the water rights of the Cartwright stone quarry.

SHELBYVILLE, IND.—The Universal Electric Company has been awarded a contract to wire the Johnson County Infirmary (689), in order that an electric lighting plant may be installed later. For the present a gas plant will be operated.

CHICAGO, ILL.—Contract has been awarded to Freyn, Brassert & Company of Chicago for the construction of a plant for the Grip Nut Company on Fifty-ninth Street, between Western Avenue and the Baltimore & Ohio, Chicago Terminal Railroad, to cost about $500,000.

DWIGHT, ILL.—The City Council is considering the installation of a new lighting system in Dwight. The Public Service Company of Northern Illinois has submitted a proposal for the installation of a new lighting system and furnishing electricity for pumping the city water supply.

DE PERE, WIS.—General contract has been awarded by the George Diamond Economy Process Company to W. E. Ule & Company of Grand Rapids, Wis., for construction of paper mill, machine shop and power plant. The cost of the buildings and equipment is estimated at about $225,000.

MILWAUKEE, WIS. — The Plankinton Packing Company is contemplating the construction of a cold-storage warehouse, equipped with refrigerating and ice-making machinery and to make other improvements, to cost about $500,000. The company is a subsidiary of Swift & Company of Chicago. C. H. Kane of Chicago, Ill., is consulting engineer. H. S. Culver of Milwaukee is vice-president and general manager.

RACINE, WIS.—The Racine Auto Tire Company is planning to build a new steam-driven generating plant and boiler house, to cost with equipment about $40,000. A. N. Becker is chief engineer.

SUPERIOR, WIS.—The installation of new ornamental lamps in the East End is under consideration by the street lighting commission.

ATLANTIC, IOWA.—Plans have been prepared for the $26,000 addition to the power plant to be erected by the city of Atlantic. Generators, pumps, motors, etc., will be purchased. Address City Clerk, Atlantic.

WAPELLO, IOWA.—It is announced that bids will soon be advertised for the installation of a new pumping plant in the lower end of the No. 13 drainage district. Charles Young is engineer.

KANSAS CITY, MO.—Plans have been prepared by the Lehrback Construction & Engineering Company of Kansas City for the construction of a large flour mill and grain elevator for the Associated Mill & Elevator Company in Kansas City, to cost about $600,000. H. C. Nunn is president of the Associated company.

OMAHA, NEB.—Petitions are being circulated asking the City Council to call a special election to vote on the proposal to issue $5,000,000 in bonds to construct power plants in the Loup and Platte River regions, to supply electricity for Omaha.

WAHOO, NEB.—The Wahoo Produce Company is planning to erect a produce and cold-storage plant in Wahoo, to cost about $40,000.

HUGOTON, KAN.—The City Council is contemplating the erection of a new electric and water plant.

ST. JOHNS, KAN.—Bids will be received by the city clerk, St. Johns, until Aug. 6 for furnishing two 80-hp. boilers and two generators. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

## Southern States

BAKERSVILLE, N. C.—The Bakersville Milling, Light & Power Company is contemplating the erection of an electric plant to cost in the neighborhood of $10,000. R. T. Teague is manager.

FAYETTEVILLE, N. C.—Improvements are contemplated to the municipal electric light plant and waterworks system.

GAFFNEY, S. C.—Plans are under way for the installation of a street-lighting system by the Board of Public Works.

LOCKHART, S. C.—The Lockhart Power Company is planning the erection of a new hydroelectric power plant on Broad River. Enslie Nicholson is president.

CEDARTOWN, GA.—The Cedartown Cotton & Export Company is erecting an addition to its cotton products plant, to cost about $40,000. The equipment will cost about $125,000. Extensions will also be made to the electric plant.

BIRMINGHAM, ALA.—Plans are under consideration by the Alabama Packing Company, 3031 Twenty-first Avenue N., for extensions to its plant, to cost about $200,000.

NATCHEZ, MISS. — Extensive improvements are being made to the plant of the National Box Company, including the installation of an electric power plant. All machinery will be operated by electricity. The cost of the improvements is estimated at about $2,000,000.

RULEVILLE, MISS.—The City Council is considering an issue of $40,000 in bonds for improvement to the municipal electric light plant and for street improvements.

BRISTOL, TENN.—The Tennessee Electric Company of Bristol has asked for an increase of capital stock from $10,000 to $15,000.

TEXARKANA, ARK. — The Texarkana Telephone Company is contemplating extensions and improvements involving an expenditure of about $60,000.

UNION, ALA.—Arrangements have been made by the City Council for an issue of $10,000 in bonds to provide funds for extensions and improvements to the municipal electric light plant.

DALLAS, TEX.—The Dallas Power & Light Company will increase its capital stock from $1,000,000 to $2,500,000.

SAN ANGELO, TEX.—A citizens' committee is considering the erection of a water, light and power plant.

SUGARLAND, TEX. — Westinghouse, Church, Kerr & Company have been awarded a contract for the building of a power plant for the Sugarland industries Company at Sugarland.

CHELSEA, OKLA.—Bonds to the amount of $30,000 have been authorized for the construction of a water and light plant in Chelsea.

NEWKIRK, OKLA.—A bond issue for $100,000 has been approved by the Attorney General for electric lighting for Newkirk; also a $70,000 bond issue for waterworks extensions.

## Pacific and Mountain States

SEATTLE, WASH.—The Mayflower Dairy Company recently authorized Brietung & Company to plan a one-story power house and storage building to be erected at 917 Virginia Street on the southeast corner of Virginia and Terry Avenue. The building will cost $24,000.

ROSEBURG, ORE.—The question of municipal ownership of the water and light plants is under consideration by the City Council.

DURHAM, CAL.—The Durham Light & Power Company has applied to the Railroad Commission of California for permission to sell its property.

LOS ANGELES, CAL.—Work will begin on the construction of High Dam at Devil's Gate. The structure will be more than 100 ft. high.

MODESTO, CAL.—Bonds, amounting to $609,000 to provide funds for the construction of a power plant will be voted on.

OAKDALE, CAL.—Plans are being prepared by the Calveras Copper Company for a reservoir and power plant ot Oakdale to supply electricity for its plant at Copperopolis.

SIERRA MADRE, CAL.—Plans are under consideration for civic improvements, involving an expenditure of about $100,000, which will include extensions to waterworks, sewer systems and installation of ornamental street lamps.

WYANDOTTE, CAL.—William Boucher, manager of the Chamber of Commerce, and Edward Johnson, superintendent of the Marysville district of the Pacific Gas & Electric Company, are considering extending an electric lighting system to Wyandotte.

GRAND JUNCTION, COL.—The installation of a hydroelectric plant to supply light and power to practically every section of the Plateau valley is contemplated.

## Canada

EDMONTON, ALTA.—Bids will be received by the Department of Railways until Aug. 15 for the erection of 400 miles of telephone lines extending from Pembina to Fort Assiniboine and from Edmonton to Clyde, to cost about $60,000.

KAMLOOPS, B. C.—The municipalities between Kamloops and Kelowna will petition the government to develop water power at Shuwap Falls on the Adams River to generate electricity to be distributed in the Shuswap and Okanogan Valleys and to operate the Okanogan branch of the Canadian Pacific Railway, which it is proposed to equip for electrical operation.

NARAMATA, B. C.—Contract has been awarded by the Town Council to J. Winger of Peachland for the construction of power house.

VANCOUVER, B. C. — The Western Power Company of Canada is planning extensive water-power development.

ST. STEPHEN, N. B.—Plans, it is reported, have been prepared by L. H. Whealen of Halifax for extensions and improvement to the plant of the St. Stephen Electric Light Company.

GALETTA, ONT.—The Galetta Power & Milling Company contemplates extensions to its electric transmission lines.

WIARTON, ONT.—The Sauble Falls Light & Power Company is planning a water-power development.

MONTREAL, QUE.—Work will soon begin on equipping the railway of Montreal Harbor Commission for electrical operation.

## Miscellaneous

MONTEREY, MEXICO.—According to announcement made by the Department of Communications and Public Works of the Mexican government, it has just entered into a contract with the Mexican Tramways Company, Ltd., for the resumption of construction of the interurban electric line that is to run between the City of Mexico and Puebla, about 130 miles. The proposed interurban electric line to Puebla will traverse a route that passes close to the foot of Mount Popocatepetl and Ixtaccihuatl volcanoes.

# Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 10, 1918)

1,287,587. CONDUIT REDUCER AND CONNECTOR; Leonard M. Hickey, Milwaukee, Wis. App. filed Nov. 29, 1916. Height and number of units reduced.

(Issued May 20, 1919)

1,303,870. AUTOMOBILE; Roland S. Fend, Chicago, Ill. App. filed June 26, 1915.

(Issued July 15, 1919)

1,310,191. ELECTRICAL FITTING; Cecil R. Hubbard, Baden, Pa. App. filed Feb. 2, 1918. Attaching lug.

(Issued July 22, 1919)

1,310,585. HIGH-POTENTIAL SWITCH; George T. Southgate, Brooklyn, N. Y. App. filed Oct. 6, 1917. Air-break switch with discharge horns so correlated with contacting elements that when circuit is opened the arc will be transferred from elements to the horns.

1,310,784. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Oct. 4, 1918.

1,310,785. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Oct. 4, 1918.

1,310,786. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Nov. 16, 1918.

1,310,787. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Nov. 16, 1918.

1,310,788. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Nov. 16, 1918.

1,310,789. CLOCK-SYNCHRONIZING DEVICE; James W. Bryce, Binghamton, N. Y. App. filed May 8, 1919.

1,310,802. MAGNETIC SEPARATOR; Robert A. Manegold and George H. Forbian, Milwaukee, Wis. App. filed March 30, 1917. Stationary magnets.

1,310,813. SIGNAL; Albert M. Ward, Rochester, N. Y. App. filed Oct. 21, 1918.

1,310,821. PROTECTIVE RELAY SYSTEM; Orville J. Bliss, Chicago, Ill. App. filed July 29, 1918. Balanced by current flow.

1,310,838. ELECTRIC RADIATOR; Asher Pritzker, Toronto, Can. App. filed Sept. 9, 1918. Use of brackets avoided.

1,310,871. PROCESS AND APPARATUS FOR TREATING STORAGE-BATTERY PLATES; Harold M. Martin, New York, N. Y. App. filed Nov. 14, 1914. Oxidation prevented.

1,310,873. FUEL VAPORIZER; Bertram J. Pye and Henry Rabbes, Oakland, Cal. App. filed Aug. 21, 1918.

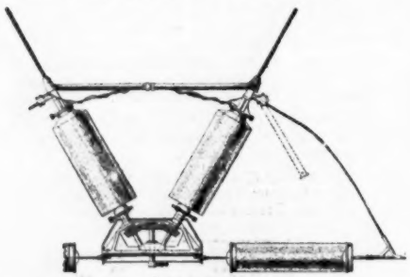
1,310,900. TELEPHONOGRAPH; Hugo Ullman, St. Gallen, Switzerland. App. filed March 26, 1919.

1,310,994. ELECTRICAL HEATING UNIT; Frank Kuhn and Frank E. Shailor, Detroit, Mich. App. filed Sept. 9, 1915. Continuous resistor.

1,311,019. AUTOMOBILE ALARM; Thomas H. Smith, El Paso, Tex. App. filed Sept. 26, 1917.

1,311,027. ELECTRIC CURRENT LIMITER; Yohtaro Uchida, Tokyo, Japan. App. filed June 18, 1917. Magnetic type.

1,311,033. PROTECTED THIRD-RAIL; John A. F. Aspinall, Liverpool, England. App. filed July 24, 1914. Flanged conductor.



1,310,585—High-Potential Switch

1,311,063. LIGHTNING ARRESTER; Albert Gabel, Muscatine, Iowa. App. filed April 15, 1919.

1,311,067. INSULATOR; Watler T. Goddard, Hamilton, Ont., Can. App. filed June 7, 1916. Even distribution.

1,311,096. ELECTRODE; Elias A. C. Smith, New York, N. Y. App. filed Jan. 7, 1918. Silicon type.

1,311,118. THREE-POSITION ANNUNCIATOR; Wesley H. Geiger, Wormleysburg, Pa. App. filed April 23, 1914.

1,311,133. ARC-LAMP ELECTRODE; William R. Mott, Lakewod, Ohio. App. filed Oct. 2, 1918. Metallic tantalum and compounds.

1,311,135. APPARATUS FOR OPERATING AUTOMOBILE SIGNS; Alfred W. Olds, Windsor, Conn. App. filed Jan. 23, 1917.

(Issued July 29, 1919)

1,311,156. AUTOMATIC TEST AND RINGING CIRCUITS; Hirma D. Currier, Chicago, Ill. App. filed April 5, 1915.

1,311,157. SUBMARINE SIGNALING; Reginald A. Fessenden, Brookline, Mass. App. filed March 13, 1918.

1,311,204. THERMAL CIRCUIT CLOSER; Joseph C. Baker, Denver, Col. App. filed Nov. 27, 1918.

1,311,208. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; Harold L. Blood, Plainfield, N. J. App. filed Sept. 26, 1914. Automatic and manual control.

1,311,209. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; Harold L. Blood, Plainfield, N. J. App. filed Sept. 26, 1914.

1,311,214. CIRCUIT CLOSER; William Donahue, New York, N. Y. App. filed March 30, 1917.

1,311,231. PROCESS OF MAKING NITROGEN COMPOUNDS; Charles B. Jacobs, Bloomfield, N. J. App. filed Dec. 26, 1914. Cyanides and compounds.

1,311,233. BURGLAR ALARM; Isadore Jasculca, Milwaukee, Wis. App. filed Feb. 12, 1918.

1,311,244. LIQUID INDICATOR FOR TANKS; William R. Pippin, Paris, Tex. App. filed Aug. 22, 1917.

1,311,260. COMBINED SWITCH AND CONNECTOR FOR ELECTRIC CIRCUITS; Carl Bramming, Chicago, Ill. App. filed Feb. 19, 1917.

1,311,262. ELEVATOR; Edward P. Collins, Chicago, Ill. App. filed March 19, 1917. Cylindrical motor controller.

1,311,263. ELECTRIC SWITCH; Otis L. Davis, Iowa City, Iowa. App. filed Jan. 12, 1917.

1,311,264. OSCILLATION GENERATOR; Lee de Forest, Spuyten Duyvil, N. Y. App. filed Sept. 4, 1915. Oscillation energy modified.

1,311,266. PLUG AND RECEPTACLE; Arthur H. Fargo, Poughkeepsie, N. Y. App. filed March 4, 1915. Grips automatically increased.

1,311,276. METAL-WORKING MACHINE; Louis A. Hawthorne, Newark, N. J. App. filed May 5, 1917.

1,311,283. AMPLIFYING AND CORRECTING SYSTEM; Robert C. Mathes, New York, N. Y. App. filed Aug. 14, 1918.

1,311,345. TAIL-END LIGHT FOR AUTOMOBILES; John R. Green, Dalhart, Tex. App. filed Nov. 3, 1917.

1,311,376. ELECTRIC CONDUIT FITTING; Carl H. Bissell and Elda G. Smith, Syracuse, N. Y. App. filed July 11, 1917. Compact.

1,311,378. PROCESS OF PRODUCING ALKALI-EARTH METALS; Warren F. Bleecker and Walter L. Morrison, Cannonsburg, Pa. App. filed Oct. 19, 1915. Metalloid reducing agent.

1,311,379. APPARATUS FOR PRODUCING ALKALI-EARTH METALS; Warren F. Bleecker and Walter L. Morrison, Cannonsburg, Pa. App. filed Oct. 19, 1915.

1,311,402. ELECTRICAL SYSTEM FOR ENGINES; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed June 24, 1914.

1,311,403. ELECTRICAL SYSTEM FOR ENGINES; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed June 24, 1914.

1,311,422. METHOD OF WELDING PLATES; Thomas J. Shea, Portland, Ore. App. filed April 5, 1919. Waste avoided.

1,311,430. PORTABLE AUDIPHONE TRANSMITTER; Charles E. Williams, Chicago, Ill. App. filed Oct. 3, 1917.

1,311,432. SYSTEM OF MULTIPLYING TRUNK WIRES; William Aitken, London, Eng. App. filed March 20, 1917.

1,311,437. FLASHER; Wade C. Conklin, Highland Park, Mich. App. filed July 2, 1917.

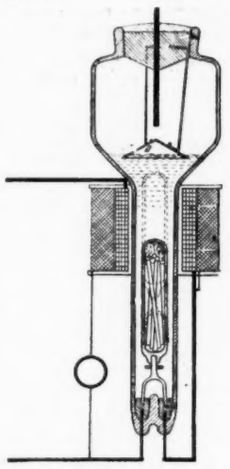
1,311,458. STARTING MECHANISM; John P. Nikonow, Wilkinsburg, Pa. App. filed July 24, 1914.

1,311,459. CUT-OUT; Francis H. Patten, Wilkinsburg, Pa. App. filed May 11, 1914.

1,311,460. CUT-OUT; Francis H. Patten, Wilkinsburg, Pa. App. filed Sept. 10, 1914.

1,311,462. CONTROL SYSTEM; Lynn G. Riley, Wilkinsburg, Pa. App. filed May 6, 1915.

1,311,464. ELECTRIC HEAT-STORING APPARATUS; Oskar Saelid and Kristian Petersen, Sarpsborg, Norway. App. filed April 28, 1918.



1,311,027—Electric Current Limiter

1,311,466. COIL-RETAINING DEVICE; Michael Sandfield, Wilkinsburg, Pa. App. filed Dec. 14, 1915. Longitudinal movement eliminated.

1,311,483. INSULATOR; Frank Amos, Wheeling, W. Va. App. filed Nov. 28, 1917. Firm clamping.

1,311,489. MECHANICAL RECTIFIER; Quincy A. Brackett, Pittsburgh, Pa. App, filed April 29, 1915. Sparkless.

1,311,490. VIBRATING RECTIFIER; Quincy A. Brackett, Pittsburgh, Pa. App. filed May 14, 1915. Windings simplified.

1,311,491. ELECTRICALLY OPERATING SURGICAL-NEEDLE DEVICE; Ervin M. Camp, Denver, Col. App. filed March 13, 1919.

1,311,495. EXTENSIBLE SUPPORTING STAND FOR MULTIPLE NUMBERS OF ELECTRICALLY OPERATING SURGICAL NEEDLES; Ervin M. Camp, Denver, Col. App. filed March 13, 1919.

1,311,503. LIGHTNING ARRESTER; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed March 14, 1917. Direct insertion.

1,311,506. ELECTROLYSIS OF SOLUTIONS; Vilhelm Grunner, New York, N. Y. App. filed Feb. 13, 1918. Employs water glass.

1,311,507. TRANSFORMER; George Harlow, Altrincham, Eng. App. filed June 20, 1916. Coils secured.

1,311,510. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 12, 1915. Plurality of squirrel-cage windings.

1,311,511. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 29, 1915.

1,311,512. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 7, 1916. Resistance losses lessened.

1,311,513. FIELD-CONTROL SYSTEM FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 9, 1916. Uniform acceleration.

1,311,514. CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 25, 1914. "Flash-over" prevented.

1,311,542. DYNAMO-ELECTRIC MACHINE; William A. Turbayne, Niagara Falls, N. Y. App. filed Jan. 25, 1917. Improved field structure.

1,311,559. PROCESS OF RESUSCITATING SPENT DRY CELLS; Kazuo Horii, Kokkaido, Japan. App. filed May 29, 1918. Renewable.